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CASSELL'S

NATURAL HISTORY.

EDITED BY

P. MARTIN DUNCAN, M.B. (LOND.), F.R.S., F.G.S.,

PROFESSOR OF GEOLOGY IN AND HONORARY FELLOW OF KING'S COLLEGE, LONDON,
CORRESPONDENT OF THE ACADEMY OF NATURAL SCIENCES, PHILADELPHIA.

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AVES.

R. BOWDLER SHARPE, F.L.S., F.Z.S.

REPTILIA.

PROFESSOR P. MARTIN DUNCAN, M.B. (LOND.), F.R.S., F.G.S., ETC.

AMPHIBIA.

PROFESSOR P. MARTIN DUNCAN, M.B. (LOND.), F.R.S., F.G.S., ETC.

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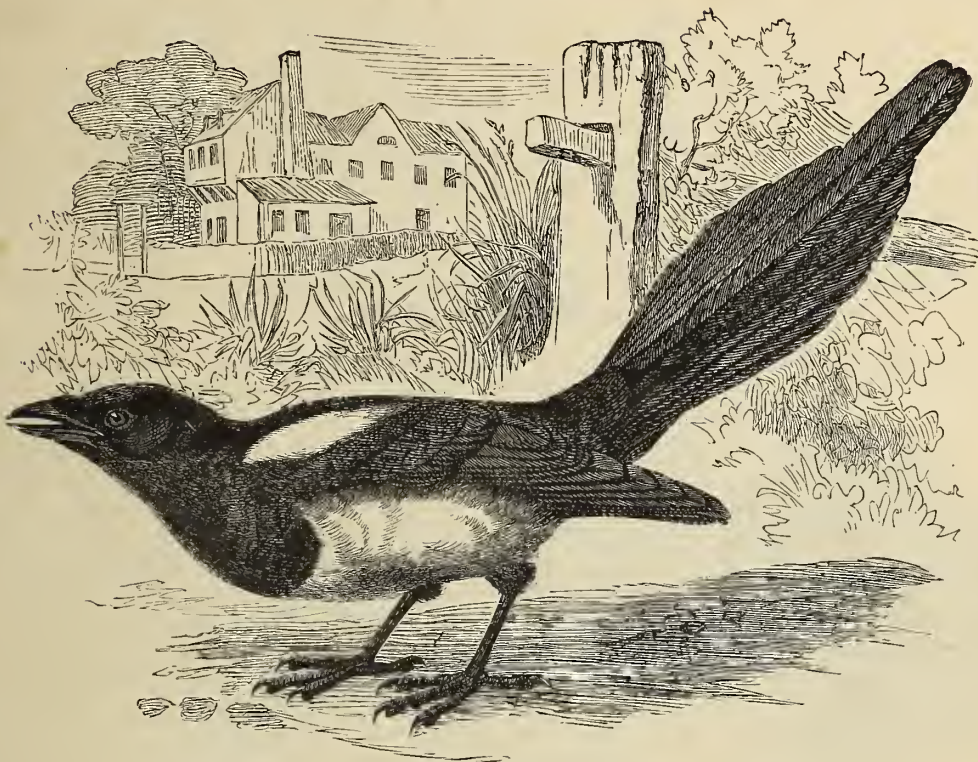
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CASSELL'S NATURAL HISTORY.



THE MAGPIE.

ORDER III.—PASSERIFORMES—THE PERCHING BIRDS.

CHAPTER I.

CROWS.

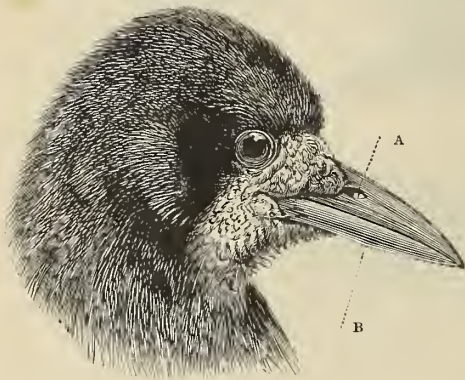
Order of Perching Birds largest of all Orders—Chief Distinguishing Features—Two Great Sections of Passerine Birds—Distribution—*SECTION ACROMYODI*—Classification by Wing—Sub-order *TURDIFORMES*—THE CROWS—Distribution—THE COMMON ROOK—Appearance—Young Rook—Bare Face—Distribution—Breeding Habits—Attachment to Nesting-places, or “Rookeries”—Is it a Useful Bird?—Its Vigorous Appetite—THE TRUE RAVENS—Distribution—THE COMMON RAVEN—Ravens of the Old and New World—Distribution—Habits—His After-Dinner Talk—THE COMMON JACKDAW—Social Character—Cleverness—Appearance—Habitat—Curious instance of Daubing its Eggs—THE HOODED CROW—Distribution—A Migration—Heligoland and its Inhabitants—THE CARRION CROW—Distribution—Inter-breeding with the Hooded Crow—Mr. Lumsden's Note on the Subject—Mr. Seebohm's Note on the Birds in Eastern Siberia—Habits—THE INDIAN GREY-NECKED CROW—Captain Vincent Legge's Account of its Habits—THE COMMON MAGPIE—Mischievous Habits—Familiarity—Instances of Nesting in Gooseberry Bushes—Appearance—THE TREE PIES—THE INDIAN TREE PIE—THE COMMON JAY—Its Bad Character—As a Pet—Appearance—THE BLUE JAYS—THE COMMON BLUE JAYS—THE LONG-TAILED BLUE JAYS—THE BARE-NECKED CROW—THE HUIA, OR NEW ZEALAND WOOD CROW—Curious Form—Dr. Buller's Account—Its Habitat—Rarity—Disposition—How Specimens were Caught—Diet—How they Searched for Food—Second Sub-family of the Crows—Choughs.

THE order of Perching Birds, known to our readers by the names of Passerine birds, or Insectores, is the largest of all the orders, and contains more than half of the whole number of birds now known. One of the chief distinguishing features of a Passerine bird is its foot, which is simple and ordinary in construction, with well developed toes and claws, the claw of the hind toe being larger than that of any of the other toes. The breast-bone, or sternum, is simple, having only one notch in the hinder margin: and in this respect it differs at once from that of all the Picarian birds which have been treated of in the preceding

chapters. The eagerness with which, up to the present time, the feet of birds have been seized upon as of primary importance in their classification can hardly be wondered at, when the remarkable diversity in regard to these organs exhibited by the different orders of birds is taken into consideration. In the case of an Eagle, for instance, what can be more admirable than the proportions of the feet and talons for the capture of its quarry? And the same holds good with all the *Accipitres*, or birds of prey, not to mention the *Zygodactyle* Woodpeckers, which have been already discussed, while the long toes of the Rails, the webbed feet of the Ducks and Gulls, are all indications of a perfect adaptability of these organs to the habits of the birds. The Passerine birds are divided into two great sections, which are called *Passeres acromyodi* and *Passeres mesomyodi*, from peculiarities in their voice organs, the first section containing the songsters of the world, the second containing the songless birds.

SECTION A.—ACROMYODI, SINGING BIRDS. SUB-ORDER I.—TURDIFORMES, THRUSH-LIKE BIRDS.

Geographical distribution also helps to distinguish these two leading groups of the Perching birds: for the *Acromyodian Passeres* are chiefly inhabitants of the Old World, as the *Mesomyodian Passeres*



HEAD OF ROOK.

are of the New. The principal character by which the leading groups are distinguished is the wing, and the classification based on this feature, which is easy to understand, will be the one adopted in the present work. The first group bears the name of *Turdiformes*, or Thrush-like *Passeres*, and in all these birds the wing has ten primary feathers, the first being always markedly reduced in size. The leading group of these birds is known as the *Coliomorphae*, or Crow-like birds, and contains five families: Crows (*Corvidæ*), Birds of Paradise (*Paradisidæ*), Orioles (*Oriolidæ*), Drongos (*Dicruridæ*), and Wood-Shrikes (*Prionopidæ*). All the members of these five families have the chin-angle (*angulus menti*) produced very far forwards (B), so as to extend beyond a line drawn perpendicularly down the front edge of the nostril (A).

What is meant is shown in the accompanying illustration. It is true that in some of the Jays this prominence of the chin-angle is not so marked, but still sufficiently so to determine that they are Crows; while some Creepers (*Certhiidae*) have the same character of bill, but then their long curved beaks and spiny tails prevent their being mistaken for any of the Crow family or its allies.

THE FIRST FAMILY OF THRUSH-LIKE PERCHING BIRDS.—THE CROWS (*Corvidæ*).

These are found nearly all over the globe in some form or other; that is to say, either as Crows or as Jays, the latter predominating chiefly in South America, where no true Crow is met with; and in most of the Pacific Islands no member of the family at all is found. Even the deserts of Central Asia have their own representatives in the form of Desert Choughs, belonging to the genus *Podoces*, while nowhere is the family more strongly developed than in the islands of the Malay Archipelago.

The habits of many of the Crows change with the localities they inhabit, and a species will be wild and unsociable in one place, while in another the same bird will be tame and confiding; and although in England the Crows, with the exception of the Rook and Jackdaw, live only in country districts, species precisely similar in habits and appearance are found in other parts of the world, inhabiting towns and doing the duty of scavengers.

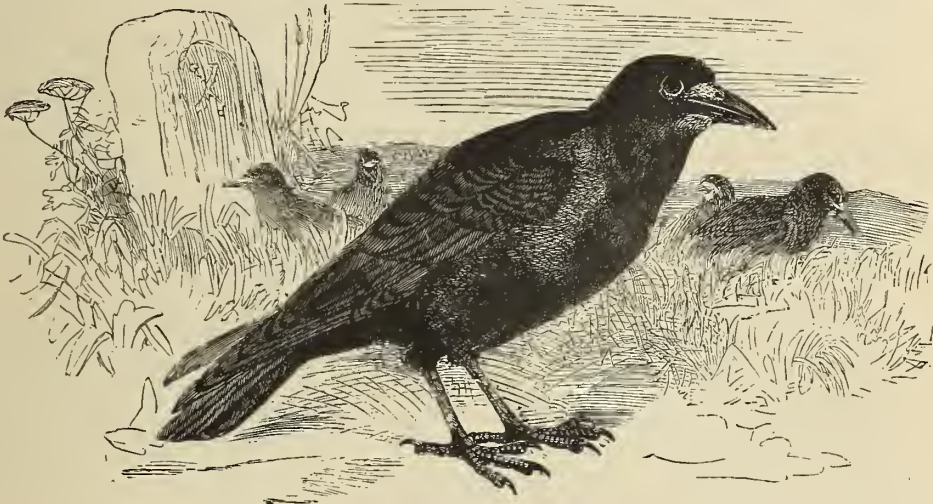
The Choughs are peculiar Crows, distinguished by the position of the nostril, which is placed low in the upper mandible of the beak and generally hidden by a tuft of bristly feathers. They are to be considered as belonging to a separate sub-family (*Fregilinae*). The rest of the Crows are placed in the sub-family *Corvinae*.

SUB-FAMILY CORVINÆ.

In this sub-family is found a great diversity of form, as it contains, besides the true Crows, all the Jays, Magpies, Hill Crows, and even such apparently different birds as the Huia bird and Wattle Starling of New Zealand.

THE COMMON ROOK (*Trypanocorax frugilegus*).

To any one who has not handled a Rook it would perhaps be a matter of surprise, on his first acquaintance with it in person, to find it such a handsomely burnished bird, for in the distance its appearance is dull black. Both male and female, however, have a most beautiful gloss of purple and green on the plumage, but this they share with many others of the Crow family; one peculiarity they have for their own, and that one is their bare face. How the bird gets its visage denuded of plumes is a problem still unsolved, for the young have the head fully feathered, and only obtain the bare face during their first winter. Up to this time a young Rook might easily be mistaken by an inexperienced eye for a Carrion Crow, but the Rook can be recognised at any age by its having the base of the feathers *grey*, and not *white*, as in the latter species. An idea



THE COMMON ROOK.

prevalent amongst naturalists for many years was that the Rook's face became denuded of feathers through the bird's habit of thrusting its bill deep into the ground in search of food, but that this cannot be the case is proved by the fact that no such result is found to occur in allied species of similar habits, such as the Carrion Crow, for instance; while it is certain that at times, when the hardness of the ground prevented the Rooks digging for food, these bare places would be replenished by a new stock of feathers: and this we know not to be the case. This bare face, then, must be considered to be an individual peculiarity in the Rooks, and it is found, though not to the same extent, in the Chinese Rook (*Trypanocorax pastinator*).

The Rook is found all over Europe, but does not extend into the high north, and only occasionally straggles beyond the line of the Tropic of Cancer. It breeds throughout Central Europe between 60° and 40° N. lat., and above the former line it rests only in certain portions of Norway and Sweden and near Archangel. To Southern Europe it is only a winter visitant, and it is found in North-western India in the winter also. In some parts of North-western Turkestan it breeds, but is found in Yarkand only in the winter. To the eastward of this last locality we have no trace of it, and it is not until we come to Eastern Siberia and Northern China that we meet with its cousin, the Chinese Rook.

It differs from its European congeners in being gregarious and always breeding in colonies. It evinces great attachment to its nesting-place, and the same nests are used by the birds year after year, being repaired each season. It is an early breeder, beginning to make ready the nest in February or March, and it has been known to commence the repairs as early as the 16th of the former month. It

is essentially a civilised bird, and rookeries are generally found in close proximity to houses, and often in the midst of villages or even towns. This is the case in London itself, where a time-honoured spot may here and there be found to which the Rooks resort year after year.

Opinions are divided as to the utility of the Rook; in some places the bird being regarded as a benefactor, in others as a depredator, only fit to be shot and trapped along with other vermin. The truth probably lies between these two opinions, for although it eats an immense number of noxious insects and grubs, it will devour eggs and young birds, while there is no question as to its creating considerable havoc among the trees in the spring-time, when it breaks off large numbers of young boughs wherewith to build its nest; in the south of England, too, in the autumn, it often commits great depredations among the walnuts. As an example of the omnivorous qualities of the Rook we quote the following note, contributed by Mr. Cecil Smith to Mr. Dresser's "Birds of Europe:"—"Its appetite and digestion are perfectly astonishing; nothing seems to come amiss to it. Besides its lawful and useful food of grubs, worms, &c., I have seen it kill and eat a young Rabbit, and young Ducks or Ducks' eggs have no chance; it will devour flesh, either fresh or stale, raw or cooked, and walnuts in any quantity. Near the sea I have seen Rooks picking up and eating Sand-Eels and other small fish after the seine has been drawn, and squabbling with the Gulls for Mussels on the Mussel-beds; these it breaks in the same way as the Gulls, taking them up to a height and dropping them on a hard, stony place. I have seen it treat an obstinate walnut in the same way. Rooks seem occasionally to cast up pellets of the indigestible portion of what they have eaten, after the manner of Hawks; so I suppose their digestion is not quite equal to everything. One of these pellets which I saw a Rook cast up, and which I examined, consisted of stones, hard parts of beetles, and husks of corn. So necessary are stones to help digestion that old Rooks give them to their young before they leave the nest, and I have frequently found them in the stomachs of young Rooks shot in the Rook-shooting time, and before they had left their native tree."

THE TRUE RAVENS (*Corvus*).

The most familiar species of Raven is our own English bird, and it is also the most widely distributed. Some six other species are known: one of them, the Brown-necked Raven (*C. umbrinus*), being an inhabitant of the Mediterranean sub-region. This division of the earth comprises all the countries lying on both sides of the Mediterranean Sea, and includes Palestine and Syria, Persia and Beloochistan, as far as the confines of North-Western India. Although belonging to the Palearctic region, the above-named sub-region forms a very natural division, and is principally characterised by the presence of many Chats and Sand-Grouse, which do not occur in the more northern parts of the Old World. The islands of Madeira and the Canaries are considered, zoologically, to form an outlying part of the Mediterranean region, and they show a partial connection with the rest of Europe in the possession of a typical Bullfinch (*Pyrrhula murina*), while their zoological affinity to Algeria and Northern Africa is demonstrated by their having the same Blue Titmouse (*Parus teneriffæ*) and the same Raven (*Corvus leptonyx*).

In India a small form of Raven (*Corvus culminatus*) occurs, and another in Australia.

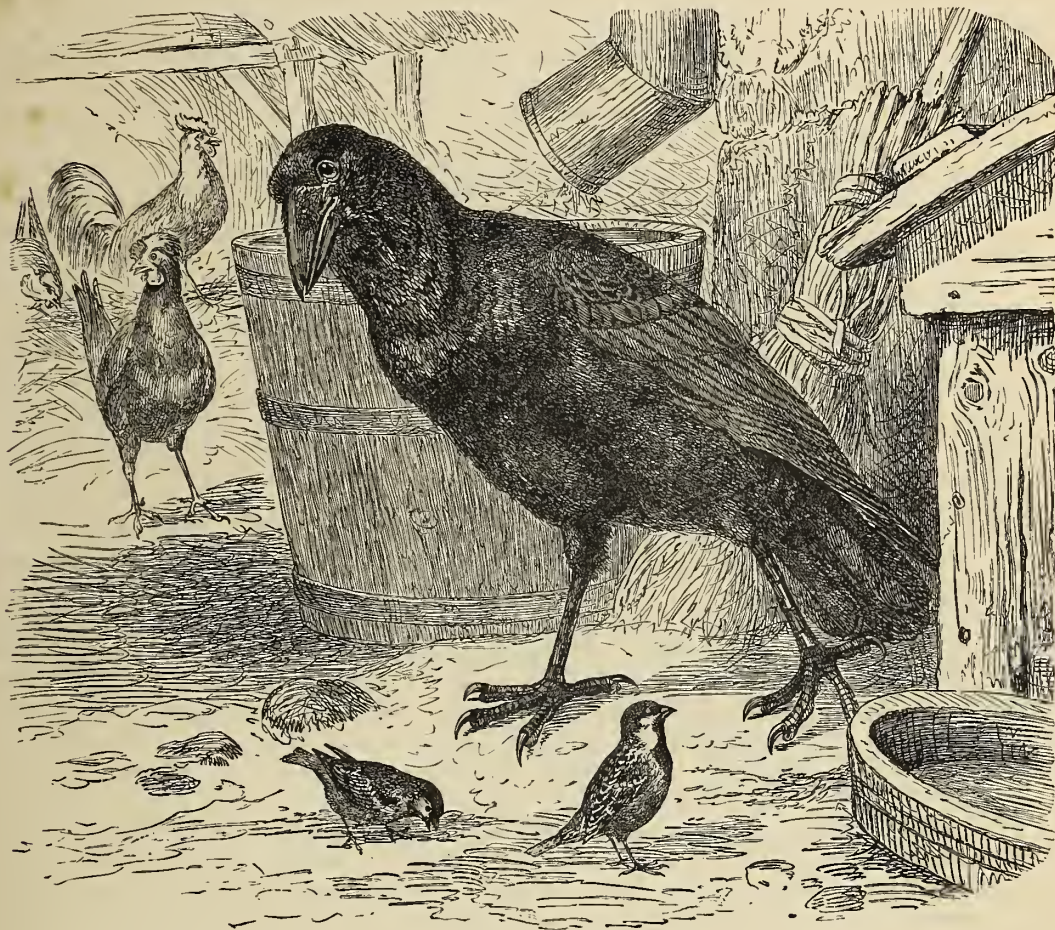
THE COMMON RAVEN (*Corvus corax*).

There are certain birds, which are found in the northern regions of the Old and New Worlds, showing the strong under-current of affinity which exists between the Avifauna of these two parts of the globe. Some ornithologists have attempted to prove that the American Raven is specifically distinct from the European one, and the Mexican bird has even been separated further from that of North America. But it seems to be an undoubted fact that the Raven is extremely variable in size, and as this is the only character which has been brought forward for its specific separation, no certain distinctions can be drawn; and in the present article all the various kinds of Raven, with the exception of those above noted, are treated as belonging to one species only (*Corvus corax*).

The Raven enjoys the credit of being the most northerly Passerine bird known, with the exception of the Snow Bunting (*Pelectrophales nivalis*); for Captain Fielden observed it, in Sir George Nares' Arctic Expedition, as far north as Cape Lupton, lat. 81° 44' N., when a pair of them were breeding during the month of July. All over Europe and Siberia, as well as Central Asia, the Raven is found in smaller or larger numbers, and in the cold weather it is found in North-Western India, being absent in China

and Japan. It is also spread all over North America as far as the table-lands of Mexico, occurring even in the extreme north of the continent. In this country the Raven is in most parts scarce, and is everywhere shy and cautious, on account of the persecution to which it is subjected, in the way in which nests are robbed of the young for sale, partly from its predatory habits, which render it objectionable to gamekeepers.

In some parks where protection is afforded to the old birds a time-honoured pair of Ravens still survive, and along the cliffs of the southern coasts of England a good many still breed. Although



THE COMMON RAVEN.

such a shy bird in many parts of its range, it exhibits in some places quite an opposite nature; and Dr. Henderson, the naturalist of the first Yarkand expedition, says that Ravens followed the camp during the whole journey, and were so familiar and bold as to render it impossible to leave anything eatable about which they did not attempt to steal. He writes:—"Even milk-pots it would deliberately upset to obtain a sup of the contents. At the greatest altitudes and through the most absolute deserts at least half-a-dozen accompanied the camp, some, doubtless, of the very same birds thus travelling the whole way from Lé to the vicinity of the city of Yarkand; when the camp divided, about half the Ravens went with each party. On first starting in the morning they always accompanied the party to a short distance, and then they returned to the old camping-ground, apparently to make sure that nothing eatable had been left behind, and there they might be seen prowling about wisely for an hour or so, again joining the party in the afternoon at the new camp." Very much the same account is given of the Raven's habits in America, where in some parts of the country it is suspicious and wary

in other parts tame and familiar. The only note which the bird utters, as a rule, is a hoarse croak ; and the idea of its having a song would seem to be impossible, but the testimony of many observers agrees in this respect. Dr. Elliott Coues says that it is not, on the whole, so noisy a bird as the Crow, though he croaks vigorously on occasions, and his caw may claim to be impressive, if not agreeable. But the queer sounds that the bird can utter, if he be so minded, are indescribable ; even his ordinary cawing is susceptible of considerable modulation. A favourite amusement of his when, his hunger appeased for the time, he feels particularly comfortable, is to settle at ease on the top of a pine-tree and talk to himself. The performance generally begins with a loud caw, self-asserting, and ends with a complacent ehuckle ; and then comes a series of comical syllables, so low as to be scarcely audible from the ground below, as if he were musing aloud and tickled with his own fancies. Then he will raise his voice again, and file away at some old saw for a while, finishing with the inimitable "cork-drawing" for which his tribe is famous. The Raven generally breeds in trees or rocks, but he modifies the position of the nesting-place ; and a good observer in California—the late Dr. Heerman—states that while he always found the nests of the Raven placed high on bold precipitous cliffs, secure against danger, in the vast desert plains of New Mexico he saw these birds building on low trees, and even on cactus plants less than three feet from the ground, showing how much circumstances and localities affect the habits of birds regarding incubation.

THE COMMON JACKDAW (*Colinus monedula*).

Although the smallest of our British *Corvidæ*, the Jackdaw may be considered the most sociable of all ; for while the Rook takes up its abode during the breeding season in colonies in the midst of villages and parks, the Jackdaw, when unmolested, may be found in the very centre of towns at all seasons of the year. His cleverness and precocity render him a very favourite pet, and he may often be seen hanging in a cage outside some village cottage, or imprisoned in the dark precincts of a London costermonger's abode. For ourselves, we never could find it in our heart to cage our tame Jackdaws, and all our numerous pets were brought up from the nest, and, as soon as they were able to feed themselves, were allowed their liberty. Acting on this plan, we have sometimes had a dozen tame Jackdaws about the house, all of whom would come for food when called, betaking themselves for the greater part of the day to the fields and woods. A Jackdaw, when feeding at his ease, presents a very stately appearance, walking about with a dignified air, with the feathers of the head and neck ruffled up ; on being alarmed or startled, he immediately becomes preternaturally sleek, every feather falling close to the body of the bird, and giving him quite a changed aspect. It is in this attitude that he is mostly represented in museums ; and it was only recently that we discovered that the ruffled appearance of the Jackdaw's head in life is produced by folds of skin upon the crown, which, unless carefully preserved in the mounted specimen, is sure to convey an unnatural impression of the bird.

The Jackdaw is found nearly all over Europe, and in most parts of the British Islands appears to be a thoroughly resident bird. In many parts of the Continent, however, he is migratory ; and we well remember seeing a large flock of over a hundred individuals pass over the island of Heligoland, where, however, it was not nearly so common as the Hooded Crow. In old cathedral towns, both in England and on the Continent, the Jackdaw is a familiar object, as it particularly affects towers and old buildings for the purpose of breeding. On the sea-shore it breeds in the cliffs in large numbers. Throughout this country, however, it as frequently nests in the holes of old trees, which it occupies year after year. In Mr. E. Shelley's park at Avington, in Hampshire, the Jackdaws occupy a group of elm-trees covered with ivy, where as many as a dozen pairs breed in company with Starlings and Stock Doves. In this same locality we once saw a huge nest exposed to the air, and built on the ledge of an unused window of a shed. The eggs vary from four to seven in number, and are somewhat more bluish in general character than those of the other British Crows. They are covered with small brown blotches and dots, which are sometimes found collected at one end of the egg, sometimes distributed almost equally over its entire surface.

The following curious circumstance is related by Mr. C. B. Wharton in Mr. Dresser's "Birds of Europe":—"On the 30th of April, 1872, I took from a hole in an old elm-tree in Cassiobury Park, Herts., four eggs of this bird, which were so evenly daubed all over with clay that the shell was almost completely invisible, and the shape and weight alone told them to be eggs. The one I washed

turned out to be rather a highly-coloured egg, but of the ordinary type. I may mention that in the nest I also found a piece of hard clay (about the size of the smallest of the four eggs), with distinct marks of a bird's beak upon it. The only reason I can think of to account for this strange conduct on the part of the Jackdaw is that it may have been done to make the eggs less conspicuous to any wandering Jay, the nest being placed not far from the mouth of the hole, and the eggs, consequently, more or less in sight of a passing bird. I showed the eggs and clay to Professor Newton and others, after one of the 'Zoo' meetings, and, if I remember rightly, you also saw them yourself; if not then, you have seen them in my cabinet, and will remember them. On the 26th of April, 1874, I took four eggs out of the very nest above mentioned, but they had nothing extraordinary about them."

Mr. Dresser adds: "I have seen the eggs above described by Mr. Wharton, and can confirm what he says respecting their being evenly and carefully daubed; and I should say that there is no doubt it was done by the bird itself, but for what reason it is impossible to say with certainty. It appears probable that it was done for the purpose of concealment."

The Jackdaw measures about thirteen inches in length, and is of a black colour, with purplish wings and tail, the back having somewhat of a greyish shade on the margins of the feathers. The crown of the head is glossy blue-black, forming a cap, while the neck is hoary grey, inclining to

silvery grey near the cap, becoming somewhat whiter on the lower sides of the neck. Bill and feet black; eye bluish-white. The sexes are alike in size and plumage.



THE COMMON JACKDAW

THE HOODED CROW (*Corone cornix*).

The distribution of the present species over Europe is somewhat singular, as, although it occurs in nearly every country, it cannot be said to be universally spread over the Continent, but rather appears to be distributed in colonies. Thus it is spread over the northern parts of Great Britain and Ireland, but diminishes in numbers as one approaches southward, where the common Carrion Crow (*C. hiemalis*) is the ordinary species. Indeed, throughout Europe these two species of Crow appear to be somewhat representative, the one replacing the other in different localities. In Northern Germany, for instance, the river Elbe appears to constitute a dividing line, for on the east side the Hooded Crow, and on the west side the common Carrion Crow, respectively breed. In the south of Europe the Hooded Crow is rarer, and occurs chiefly as a migrant, but the place *par excellence* where the migration of the present species can be most successfully studied is the little rocky island of

Heligoland. Here it was our good fortune to be a witness of the autumn passage of the Hooded Crow, which took place not—as one would have expected—in the direction of north to south, but from east to west. We had previously been acquainted with the species only in the British Islands, and, beyond an occasional autumn bird killed on the south coast, we had not had much opportunity for personally observing its habits. On arriving in Heligoland, therefore, we were not a little pleased on hearing that in a few days the *Nebel-k Krähe* might be expected, and we were informed that, if necessary, a cart-load of specimens would be easily obtainable. We had previously offered to buy specimens from the inhabitants at sixpence a head; and the supply, when once the migration had set in, fully justified our friend Mr. Gätke's experience that even a cart-load of Crows could be obtained, and our series of specimens was soon considered sufficient.

Early one morning we were taking our usual stroll along the island when we came upon a fine



THE HOODED CROW.

Hooded Crow lying dead upon the jacket of a peasant, whose gun, placed at the side, showed the way in which the bird had been brought down. Heligoland consists, as most of our readers will know, of a sandstone rock standing alone in the middle of the sea. The town nestles under the shelter of the eastern part of the rock; but the governor's house, and a considerable number of streets and buildings, including the church, are perched upon the eastern end of the rock itself; this being its widest part.

The rest of the island, on which there is very little depth of soil, consists of potato fields, from which, during the latter part of our stay, the Heligolandians were busily engaged in digging up their store for the coming winter. Nearly every man as he worked in his little patch of potato ground had his gun lying on the ground beside him ready for immediate use; and woe to the unfortunate Golden Plover who ventures by his whistle to betray his presence in the vicinity of the island! Most of the Heligolandians are good shots, and nearly all of them capital imitators of the notes of birds, so that we have often seen a flock of Golden Plover decoyed over the island again and again, until, perhaps, not more than one or two out of a dozen would finally escape with their lives.

The fact of it is that, with the exception of sheep which are kept for the purpose of supplying the islanders with milk, Heligoland has no animals at all upon it; hence all the meat that is consumed

there has to be brought direct from Hamburg, and hence the inhabitants are dependent to a great extent on their guns for fresh meat. Hooded Crows, therefore, are looked upon as a very useful article of food. We should be sorry to have to account for the number that were killed during the time the migration lasted, as for nearly five days a continual passage of these birds went on in a westerly direction. Scarcely had one flock disappeared in the distance when another was seen slowly leaving in sight from the eastward. Sometimes they would fly straight over the island, flapping lazily over the surface of the sea as they approached, and gradually rising to the cliffs as they neared them. The flock out of which we obtained our first specimen passed over at a height of about twenty-five feet above our heads. Very often, however, the sound of the fusillade which was continually being carried on would warn the approaching Crows, so that they would skirt the island at a safe distance, settling only for a few moments' rest on the cliffs at the western end. In such cases they were always more shy and difficult of approach.

The Hooded Crow is easily recognisable by its colours, which consist of a grey mantle and under-surface, the wings and tail, head and throat, being black. In Eastern Siberia, in Persia, and Palestine, the individuals of this species are very much paler in colour, and seem to constitute a distinct race, while on the shores of the Persian Gulf a very handsome form of Hooded Crow, named the Chaplain Crow (*C. capellana*), is met with.

Concerning the inter-breeding of *C. cornix* with *C. corone*, we have made some remarks in our notes on

THE CARRION CROW (*Corone hiemalis*).

We have already had occasion to allude slightly to the distribution of this bird and that of the Hooded Crow, which it represents in many of the countries of Europe: as, for instance, in Scandinavia, where the latter species is particularly abundant and the Carrion Crow entirely absent. In the southern parts of the British Islands the Hooded Crow as a breeding species seems to be extinct, according to the notes which have been contributed to Mr. Dresser's "Birds of Europe," but in many parts of Scotland the two species occur together and inter-breed. This curious fact—one of the most remarkable in the whole range of ornithology—is attested beyond all question by many excellent observers in this country and on the Continent; and, as far as observations in this country have hitherto gone, the male bird generally turns out to be a Carrion Crow and the female a Hooded Crow. Such is, however, not always the case, as is evidenced by Count von Tschusi Schmidhofen in Southern Austria, who mentions an instance of a male Hooded Crow inter-breeding with a female Carrion Crow. The following note is contributed to Mr. Dresser's "Birds of Europe" by Mr. J. Lumsden, Junr.:—"On the 18th of April this year (1874) our gamekeeper told me that he had on the previous day found a Crow's nest in a high Scotch fir on the edge of a moor, and had seen both old birds flying about, one being, he was quite sure, a grey Crow, and the other a black one. Having got this information, I started off with him at once to see the nest. As we got within two gunshots of the tree the old female (Hooded Crow) flew off, and rose, croaking, above our heads. She was at once joined by the male (Carrion Crow); and as the two birds flew round us I could distinctly see that the keeper was right—that the one bird was grey and the other black. After this I visited the nest every few days, and had frequent opportunities of identifying the birds. At first the female was very wild, and left the nest long before we were within shot of her, but always soared above us in circles, getting higher and higher each time, her cries bringing the male, who invariably came in the same direction, over the shoulder of the hill at the foot of which the tree with the nest stood. After she had been sitting for some time, however, the hen became much tamer, and would not leave the nest till the tree was struck with a stick. At this time also we noticed that the male bird was shyer, and could only see him in the distance. When the young came out, she laid down eggs and rabbits' entrails near the nest; and when watching at some distance we observed that both the old birds fed the young." Mr. Dresser, having examined the specimens, adds the following note:—"The male bird is an ordinary Carrion Crow, and the female, which at the first glance appeared to be a Hooded Crow, is, I find, on closer examination, a hybrid, though approaching nearer to the Hooded than to the Carrion Crow in coloration of plumage. Two of the young birds closely resemble the mother, whereas the other two are to all appearance ordinary Carrion Crows, exhibiting none of the characters of both species which I find in other hybrids."

The author is indebted to his friend Mr. Henry Seebohm for the following account of the two birds in Eastern Siberia, the MS. notes having been kindly placed in the author's hands for the present work :—

“During the whole of our long sledge journey from Nishni Novgorod as far as Tomsk the Hooded Crow abounded on the roadsides, and in returning during the autumn I found it equally common on the banks of various rivers which the steamer navigates between Tomsk and Tobolsk and the latter town and Tyn-main. Indeed, as far as my observation goes, the whole of Russia and Western Siberia may be described as a vast colony of Hooded Crows. East Siberia, on the other hand, is an equally vast colony of Carrion Crows. From Kras-no-yarsk to Yen-e-saïsk I saw nothing but the Carrion Crow. Middendorf records the same on the Tay-na and eastwards to the sea of Okotsk; and southwards Pjeratsky (pronounced Psheratsky) found it common in Mongolia. The distance between Tomsk and Kras-no-yarsk is about 550 versts. As you travel eastwards from Tomsk, for the first 200 versts the Hooded Crow only is to be seen. During the last 200 versts before reaching Kras-no-yarsk the Carrion Crow alone is found. In the intermediate 150 versts about one-fourth of the Crows are thorough-bred Hooded, one-fourth are pure Carrion, and the remaining half are hybrids of every stage—mulattoes, quadroons, octoroons, and so on *ad infinitum*. The line of demarcation between the two species may be roughly taken at the meridian of Calcutta, extending north of Yen-e-saïsk along the valley of the Yen-e-say, and south of that town along the watershed of the Obb and the Yen-e-say. That this state of things is not of recent origin is proved by the fact that it is recorded by Middendorf, who remarked the presence of hybrid Crows at Yen-e-saïsk as long ago as 1844. Hybrids between *C. corone* and *C. cornix* occur occasionally in Scotland, on the Elbe, in Turkestan, and probably wherever both species occur. The fact that these hybrids present a series of every intermediate form between the two species is *prima facie* evidence of their fertility. I succeeded, however, in getting positive evidence of this fact. On the 11th of May, whilst the ground was still covered with six feet of snow, I found a pair of hybrid Crows in possession of a nest near the top of a pine-tree. The nest contained one egg. On the 21st I climbed up to the nest again, and found it to contain five eggs. Two of these I took. On the 31st one egg was hatched and the other two were chipped ready for hatching. On the 26th of June I again climbed up to the nest, and found that one of the young birds had either died or flown. I took the other two and shot the female. She proved to be at least three-parts Carrion Crow. The feathers on the sides of the neck and on the lower part of the breast and belly are grey, with dark centres. I was unable to shoot the male, but I had on several occasions examined him through my binocular. He had more Hooded blood in him than the female, having a very grey ring round the neck, and showing a good deal of grey on the breast and under the wings.

“My total bag of Crows at the Ku-raï-i-ka was three thorough-bred Hooded, two males and a female; ten thorough-bred Carrions, nine males and one female; and fifteen hybrids, seven males and eight females. These figures, as far as they go, lead me to the conclusion that the female Carrion Crows were all breeding away in the woods, so that I rarely got a shot at one; whereas the female hybrids were most of them barren, so that I was able to shoot as many of one sex as of the other.”

In the central and southern counties of England, where the author himself observed the Carrion Crow, he has always found it breeding perfectly true, and in some parts of Huntingdonshire it was by no means rare. The nest was generally placed on a high tree in the middle of a field, and was in most cases difficult of access. In Scotland it is often seen in large flocks; and Mr. Robert Gray records having seen at Findlater Castle a flock which numbered 100 each of this species and of the Hooded Crow. In Southern Europe it is gregarious, as both Von der Mühle and Lindermayer speak of it as a permanent resident in Greece, large numbers retiring to roost on the rocky islands, and returning to the mainland at break of day.

The habits of the Carrion Crow are so voracious, and the bird is altogether so cunning and unscrupulous, that he is looked on by the gamekeeper as a natural enemy. Nor can we wonder at this, when we read of the havoc which a pair of these birds will work if unmolested. We well remember visiting a little group of trees, on the estate of the Marquis of Huntley at Aboyne, from which the Crows had long since taken their departure, but beneath their nests there still remained, after a lapse of several months, the *débris* of innumerable eggs of Grouse: in fact, nothing comes amiss to its maw,

and it often kills young birds, hares, and rabbits. Macgillivray adds as its food crustacea, mollusca, grubs, and worms, mentioning that the stomach of one trapped in Linlithgowshire in November, 1834, was filled with oat seeds. Its principal food, however, is carrion, and it not unfrequently attacks sickly lambs and sheep. Mr. Hogg contributes to Macgillivray's work a detailed account of the way in which a Carrion Crow sets to work to kill the lambs and ewes, first digging out the eyes, and, as the animals open their mouth in pain, attacking and tearing out their tongue, until at last the poor creatures die from exhaustion, furnishing a good meal for the Crows and their young. The Carrion Crow will sometimes attack even living birds, as Mr. Hogg witnessed the pursuit of one after a Grouse; and Montagu states that he has seen one pursue a pigeon and strike it dead.

The present species cannot be mistaken for an adult Rook, which is easily distinguished by its bare face, but with the young of the latter bird there might be some confusion, as it has its face feathered like the Carrion Crow. It is therefore as well to state that the two birds may be distinguished by examining the base of the feathers, which are grey in a Rook and white in a Carrion Crow.

The total length of the Carrion Crow is about nineteen inches, and it is all over of a glossy steel black, with a shade of purple, the feathers of the throat being lanceolate in shape.

THE INDIAN GREY-NECKED CROW (*Corone splendens*).

This species is about the size of a Jackdaw, but is closely allied to the Hooded Crow of Europe, which it resembles in its mixture of grey on the hind neck. The following account of the bird's habits is extracted from the work of Captain Vincent Legge on the "Birds of Ceylon" (p. 350):—"He is gifted with as much as, if not more intelligence, than any member of his sagacious family; and annoying as he is, on account of his large share of brains, he is nevertheless a most useful adjunct to the sanitary regulations of Indian towns. He thrives to a marvellous degree in all these, his prosperous condition depending mainly on his utter audacity, his entire disregard of man, his thieving propensities, and his accurate powers of observation. He devotes himself to the timely occupation of the back yard, the bungalow verandah, the barrack square, the abattoir, and the commissariat meat-store, or he resorts to the scene of the fisherman's occupations on the sea-beach, or the door of the native cottage at the morning hour of cooking, in all cases exactly at the opportune moment, and he is sure not to come away without his wants being satisfied. While living at Trincomalie I always found him winging his way at early morn, while it was yet dusk, in long lines to the sea-beach and to the troops' meat-store, to be in time for the dragging of the seine-net or the cutting up of the oxen; and gathering on the sands in noisy knots, or lining the branches in 'cawing' rows, these skilful robbers would never miss a chance of snatching up an unguarded morsel. But it was at meal-time in the barrack squares of Colombo that he was more particularly in his element; crowding in scores round the verandahs at the bugle-call of 'dimmers up,' the audacious thieves waited until the tables were spread, and eagerly watched for the opportunity of acquiring a midday repast. Luckless was the soldier who turned his back for an instant! From the adjacent branches to the table and back was the work of a second, and in this space of time the savoury meat had disappeared from the gunner's plate and was being discussed by half-a-dozen sable beaks. In the bungalow verandah the Crow proves himself a terrible nuisance; seated on the tops of the green 'tats,' or slyly perched on the window-sill with his head awry, he does not scruple to pounce down, and in the momentary absence of the ayah snatch the bread from the children's hands, or dart into the nursery and upset the milk-jug on the table; or he will glide noiselessly through the breakfast-room window, and in an instant pounce upon the sideboard or table, and having from afar selected the most tempting-looking cutlet or the best viands, is off again before the appu, who is laying 'master's' breakfast, can, with a well-aimed blow, effectually stop the thief. The only satisfaction that 'master' gets is the appu's tale, 'Sar! I go to kitchen for a minute, and that Crow take away master's breakfast.' I have witnessed one of these birds come into the mess-room at Colombo, pull off the napkin that had been placed over a cold joint on the sideboard, and begin pecking away most vigorously at the meat.

"Concerning the Crow's exploits in Ceylon, Layard writes as follows:—"He levies contributions on all alike: leave but your breakfast-table for a moment, and as you return, the rustling of hurrying wings, the marks of many feet on the white table-cloth, the gashes in the pat of butter, and the disappearance of plainties and small viands, proclaim who have been the robbers. The old "hopper

woman" sits frying her cakes under the lonely "pandal" of her cadjan hut, and over her, with head inclined, taking a bird's-eye view of her cookery, sits the "caca;" and now the "appah" (Anglicè, "hopper") is done, lifted from the pan, and laid on the little circular basket ready for a customer. With a grunt of satisfaction the aged crone surveys her handiwork, and drops her spoon to feel for her beloved betel-pouch. A tiresome little bit of areca nut has got into a corner, and the old dame bends over it, unmindful of her charge. A dark figure drops from the roof, and though she is instantly on the alert, and aims an ineffectual blow at the thief, the nice white "appah" is borne off. Sometimes, however, the robber has but a poor hold on it, and drops it on the red cabook road. Down pounce a host of Crows that have been looking on from many a tree, and a scuffle ensues; but anxious at least

to cheat them of their booty, if not to retain the damaged article for her own eating, the old woman hurries to the rescue. But this makes matters worse; the castle is defenceless, and unseen foes drop down from beam and rafter or fly in through open doors. The rice-basket is invaded, the chilli-box overturned, the dried fish stolen, and lucky is the dame if the crash of most of her little store of crockery and glass, swept to the ground and scattered in shining fragments, does not hastily recall her to her hut.

"This account is by no means overdrawn, for to the natives of the bazaars the Crow is an utter pest. I question, however, whether his absence from the towns would not in the end lead to much harm, for he is a most useful scavenger, and clears the streets and back premises of everything thrown out from the houses, which would otherwise speedily decompose in the rays of the tropical sun. Notwithstanding its utter disregard for the native (which is so great that I have seen one pounce on to a basket carried on a boy's



THE NUTCRACKER

head and seize from it a cake or a fruit), it entertains a marked respect for the white man, and stands in a wholesome dread of the gun, flying off the moment a stick even is pointed at it; and so quick-sighted is it that it espies any one trying to stalk it, and decamps at once, though it has not seen the gun in the enemy's hand!

"At certain hours in the day these Crows assemble in large flocks, and hold a noisy parlance which lasts for some time. At Colombo it was usually on the beach at the 'Galle Buck,' over an evening meal on sandflies, which they are very fond of, or engaged in pranks with the hermit-crabs, that the affairs of the day seemed to be discussed. Often at midday a noisy meeting would take place on the banks of the lake, and while several dozen birds held an angry debate on some fellow Crow who was posted in the middle of the circle, others would bathe up to the thighs in the water, ducking themselves and splashing in all directions. A striking instance of the Crow's love of mischief and his innate impudence was exemplified at Colombo in his habit of annoying the unoffending little Grebes

which frequented the lake. Apparently for the sake of seeing them disappear under the water he would dart down on them over and over again.

"In the towns the Grey Crow invariably roosts on the fronds of cocoa-nut trees, sitting close together in rows, but not settling down for the night until a considerable time had been spent in noisy discussion. It appears to feel the tropical heat at midday, taking shelter under the shadiest branches, and often panting with its bill wide open."

THE COMMON MAGPIE (*Pica rustica*).

So mischievous a bird is the Magpie (see figure on p. 1) to the farmer and poultry-keeper, that it is subjected to a great amount of persecution in return for the havoc it undoubtedly commits in the poultry-yard; and it requires all its natural sagacity to defend itself and its nest and young from destruction. It is probably owing to the way in which it is shot that it has become rare in certain parts of England, especially in the well-preserved game districts. At the same time, it cannot be said to be decreasing greatly in numbers throughout the country; and we can remember to have found as many as sixteen Magpies' nests during a day's birds'-nesting in Huntingdonshire. In the parts of Berkshire, on the other hand, around Cookham and its neighbourhood, where many of our field observations have been carried on, it is decidedly a scarce species. The Magpie is generally seen in pairs, but sometimes large flocks occur. A friend, Mr. James Mallam, of Ifley, informed the author that he once saw upwards of forty Magpies together in a wood in Hampshire. In other countries of Europe, such as Norway and Sweden, where the bird is looked upon with favour, it becomes very familiar, and may be found nesting close to the houses in the gooseberry-bushes. A similar instance of familiarity was communicated to Bishop Stanley by a friend, and is recorded in the "History of Birds" as follows:—"Observing, in a remote and barren part of the north of Scotland, the Magpies hopping round a gooseberry-bush, and flying in and out of it in an extraordinary manner, he noticed the circumstance to the owners of the house in which he was, who informed him that as there were no trees in the neighbourhood they had for several years built their nest and brought up their young in that bush; and that Foxes, Cats, Hawks, &c., might not interrupt them, they had barricaded not only the nest, but the bush itself, all round with briars and thorns in a formidable manner. The materials in the inside of the nest were soft, warm, and comfortable to the touch; but all round, on the outside, so rough, strong, and firmly entwined with the bush, that without a hedge-knife, or something of the kind, even a man could not, without much pain and trouble, get at their young, the barrier from the outer to the inner edge being above a foot in breadth. Frogs, Mice, or anything living were plentifully brought to their young. One day, one of the parent birds attacked a Rat, but not being able to kill it, one of the young ones came out of the nest and assisted in its destruction, which was not finally accomplished till the other old one, arriving with a dead Mouse, also lent its aid. The female was observed to be most active and thievish, and withal very ungrateful; for although the children about the house had often frightened Cats and Hawks from the spot, yet she one day seized a chicken, and carried it to the top of the house to eat it, where the hen immediately followed, and having rescued the chicken, brought it safely down in her beak; and it was remarked that the poor little bird, though it made a great noise while the Magpie was carrying it up, was quite quiet and seemed to feel no pain while its mother was carrying it down. These Magpies were supposed to have been the very same pair which had built there for several years, never suffering either the young when grown up or anything else to take possession of their bush. The nest they carefully fortified afresh every spring with rough, strong, prickly sticks, which they sometimes drew in with their united forces, if unable to effect the object alone."

The protection which the Magpie places round its nest, so as to render it a perfect *chevaux de frise*, is a necessary one, not only to guard against the depredations of the prowling birds'-nester, but also to resist the charge of small shot which the farmer or keeper relentlessly fires at any nest supposed to contain young birds. The eggs vary in number from six to eight, and are generally pale bluish-white, spotted with brown or greenish-brown. The markings vary considerably; and we remember taking a single egg from a nest in Huntingdonshire which had the larger end entirely clouded with small spots, while the following morning we found another egg on which the spots were entirely confined to the small end. The Magpie evinces considerable affection for a certain locality

during the breeding season, and several instances have been recorded of birds maimed by shot in one season returning to nest in the same place the following year.

The Magpie is about sixteen inches in length, of a glossy black plumage, slightly greenish on the crown and back, with a slightly coppery tinge on the head; across the rump a more or less distinctly marked white band; scapulas, or shoulder-feathers, white; wings blue; the primary coverts and outer web of primaries green; the inner secondaries bright blue, shading into green; all the primaries white for nearly their entire length, the tip only black; tail lustrous dark green, dusky black at the tip, before which the feathers are shaded with copper, purplish-red, or purplish-blue; throat and chest glossy black, with grey streaks on the latter; rest of under surface white; the abdomen, thighs, and under wing and tail-coverts black.

THE TREE-PIES (*Dendrocitta*).

These birds might almost be called Indian Magpies, as they form one of the genera characteristic of the Indian region. They are plentiful all over India, the Burmese countries, Southern China, and the islands of Hainan and Formosa, and extend as high as Ningpo on the Chinese coast. The presence of a Tree-pie in the last-named locality shows how the Indian Avifauna pushes its way up within the limits of the eastern Palearctic region, which is supposed to include all China north of the river Yangtze, and many instances can be brought forward of the occurrence of truly Indian genera in Northern China and Japan. The island of Sumatra contains a very fine species of Tree-pie peculiar to itself, viz., *D. occipitalis*; and the Andaman Islands also contain a single representative, *D. bayleyi*.

In general form the Tree-pies are very like true Magpies (*Pica*), but they have the middle tail-feathers widened out at the tips in a very remarkable degree. They are noisy birds, and have a variety of notes. They build large nests of sticks, lined with leaves, fine straw, tendrils, roots, &c.

THE INDIAN TREE-PIE (*Dendrocitta rufa*).

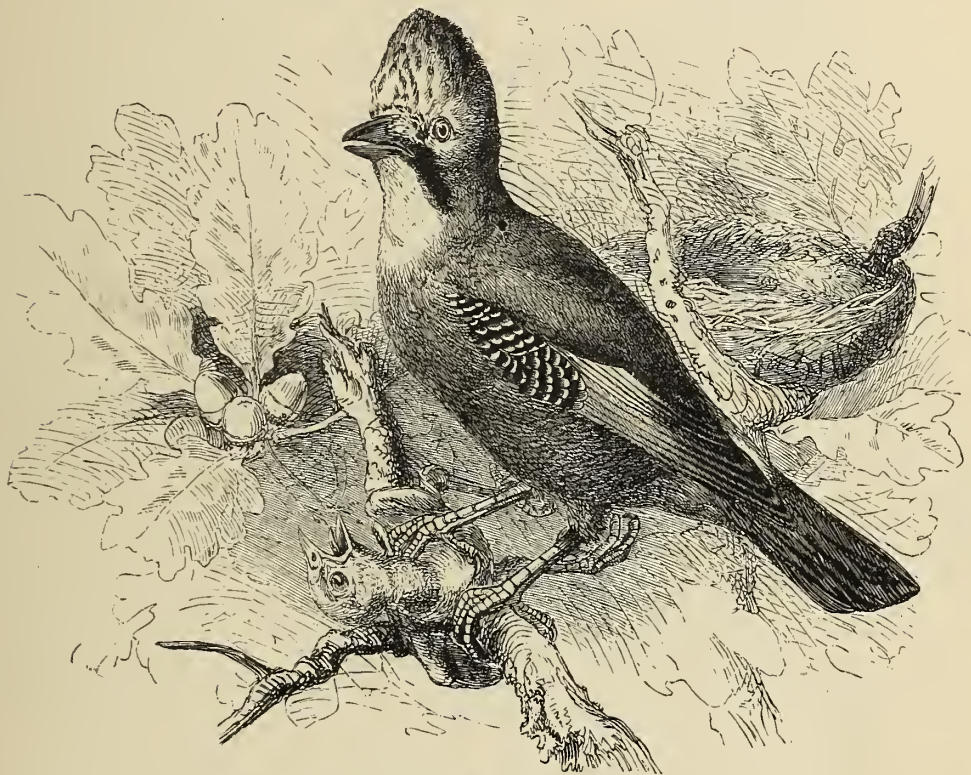
This is the commonest and best known species, being found all over India. According to Mr. Hume, it breeds throughout the continent of India, alike in the plains and the hills, up to an elevation of 6,000 or 7,000 feet. Jerdon* states that in the plains it is most common in well-wooded districts; and in the Carnatic and bare table-land it is found only occasionally about the larger towns and in hilly jungles; but as you go farther north, it is to be seen in every grove and garden and about every village. It sometimes occurs singly, very frequently in pairs, and now and then in small parties. It flies from tree to tree with a slow, undulating flight. At times it feeds almost exclusively upon fruit, but at other times on insects, grasshoppers, locusts, mantides, and caterpillars. The natives always assert that it destroys young birds and eggs, and consider it of the Shrike genus. Mr. Smith says he "has known this bird enter a covered verandah of a house, and nip off half a dozen young geraniums, visit a cage of small birds, begin by stealing the grain, and end by killing and eating the birds, and repeating these visits daily till destroyed." Mr. Buckland informs me that he has known it enter a verandah and catch bats. It has a variety of notes: the usual harsh cry of a Magpie; a clear, whistling, somewhat metallic call, which Sundevall syllabises into *Kohlee-oh-koor*, or *Kohlee-oh*, the Bengalese into *Kotree*; and it has also a feeble, indistinct note at the pairing season, which the male utters, and the female responds to in a sort of chuckle. When several pairs are together they have a curious guttural call, which the Rev. Mr. Phillips, as quoted by Horsfield, says "sounds like *kakak*, or *keke-kak*, repeated several times." It builds a large nest of sticks, generally on lofty trees, and lays three or four eggs of a light greenish fawn-colour, sometimes with a few indistinct pale brown blotches. Buchanan Hamilton says:—"The Bengalese women imagine, whenever they hear this bird calling, that it forebodes the approach of religious mendicants, who, by partaking of the fare prepared for the family, will clean the pots used in cooking; from which circumstance its native name is derived" (Pan scraper); hence he calls it *Corvus mendicantium*, or the Beggar's Crow.

THE COMMON JAY (*Garrulus glandarius*).

The present species is by no means rare throughout Europe, and is the only Jay found until, in the neighbourhood of Constantinople and Southern Russia, it occurs along with the Black-headed Jay, which replaces it to the eastward. Like all the members of the genus *Garrulus*,

* "Birds of India," Vol. I, p. 314.

it exhibits those beautiful blue and black banded feathers in the wing which have caused it to be considered one of our handsomest British birds. It is indeed a great pity that such a beautiful species should bear such a bad character, and, what is worse, should so well deserve it. On account of its propensity for taking the eggs of game-birds, the keeper's hand is turned ruthlessly against it, and the gibbet in the preserves often shows the mouldering remains of a bright-plumaged Jay, who has atoned for his offences along with the Weasels and Stoats. According to Macgillivray, it feeds on fruit, and is particularly fond of beans and peas, but it also feeds on worms, larvæ, and snails, plunders the nests of small birds, and pounces on mice and sometimes small birds. We can ourselves vouch for its partiality to peas, for some of the earliest specimens of our acquaintance were shot in the grey dawn of the morning from a kitchen garden



THE COMMON JAY.

which was regularly visited by Jays for the purpose of attacking the rows of peas. This they did with great avidity, the crops of those examined being perfectly distended with the peas they had eaten.

The Jay is a favourite cage-bird, and becomes a very amusing pet; it is an excellent mimic, and has been said to imitate such sounds as the neighing of a horse, the sound of a saw, the calling of fowls, the barking of dogs, and other noises, with the greatest exactness. It is about thirteen inches in length, of a vinous red colour, becoming pale grey on the back; the rump and upper tail-coverts pure white; the tail black, washed with grey near the base, and having slight indications of bluish-grey bars; the wing-coverts are light grey, inclining to chestnut on the median series; the bastard wing and primary coverts barred with black and bright cobalt blue, as also are the outer greater coverts, the inner ones of the last series being black; quills black, the primaries washed with ashy grey, the secondaries shaded with cobalt near the shaft, and white for more than half of the outer web; the inner secondaries black, the innermost deep chestnut, tipped with black; the head is crested, the forehead being white, streaked with black; on the cheeks a broad band of black; the under

surface of the body pale vinous; the thighs whitish; and the vent and under tail-coverts pure white.

THE BLUE JAYS (*Cyanocitta*).

As we have before mentioned, the true Jays are strictly confined to the Old World, and their place is taken in America by a group of Corvine birds which are called Blue Jays. Of these, the most familiar is

THE COMMON BLUE JAY (*Cyanocitta cristata*).

Although in plumage he differs from the ordinary type of *Garrulus*, yet in his habits the Blue Jay seems to be in many respects similar. He is found over the greater part of North America, and where he is persecuted he becomes exceeding shy and suspicious; but in some parts of the United States, where protection is afforded him, he becomes quite tame and familiar, breeding close to houses and sometimes even in the streets of large towns. Thus Dr. Brewer states that in 1843 he saw a nest of this Jay filled with young in a tree standing near the house of Mr. Audubon in the city of New York. The same gentleman does justice to the utility of the Jay in the following paragraph:—"Dr. Kirtland has informed me of the almost invaluable services rendered to the farmers in his neighbourhood by the Blue Jays in the destruction of Caterpillars. When he first settled on his farm he found every apple and wild cherry-tree in the vicinity extensively disfigured and denuded of its leaves by the larvæ of the *Clisiocampa americana*, or the Tent Caterpillar. The evil was so extensive that even the best farmers despaired of counteracting it. Not long after the Jays colonised upon his place he found they were feeding their young quite extensively with these larvæ, and so thoroughly that, two or three years afterwards, not a worm was to be seen in that neighbourhood; and more recently he has searched for it in vain, in order to rear cabinet specimens of the Moth."*

In size the Blue Jay measures about eleven inches and a half, and is of a greyish-purple colour above, the crest being also of this colour; round the hind neck is a collar of black extending down to the fore neck, and across the forehead is another narrow line of black; under surface of body pale lilac brown, inclining to white on the lower abdomen and under tail-coverts; the cheeks are whitish, and the tail-feathers are broadly tipped with white, as also the greater wing-coverts and secondaries. These last few characters distinguish the Common Blue Jay from a group of allied species with black cheeks, blue on the abdomen, and no white tips to the secondary quills or tail-feathers. These are Steller's Blue Jay (*C. stelleri*), the Long-crested Blue Jay (*C. macrolopha*), and the two Mexican Blue Jays (*C. coronata* and *C. diademata*), the latter being scarcely separable as a species. The ordinary Blue Jay is spread over Canada and the northern and eastern United States. *C. stelleri* takes its place on the Pacific side of North America, from Columbia to Sitka, which in the Sierra Nevada is represented by an allied race, called by Mr. Ridgway *C. frontalis*. *C. macrolopha* is the species of the Rocky Mountains, and *C. diademata* of the highlands of Mexico.

THE LONG-TAILED BLUE JAYS (*Xanthura*).

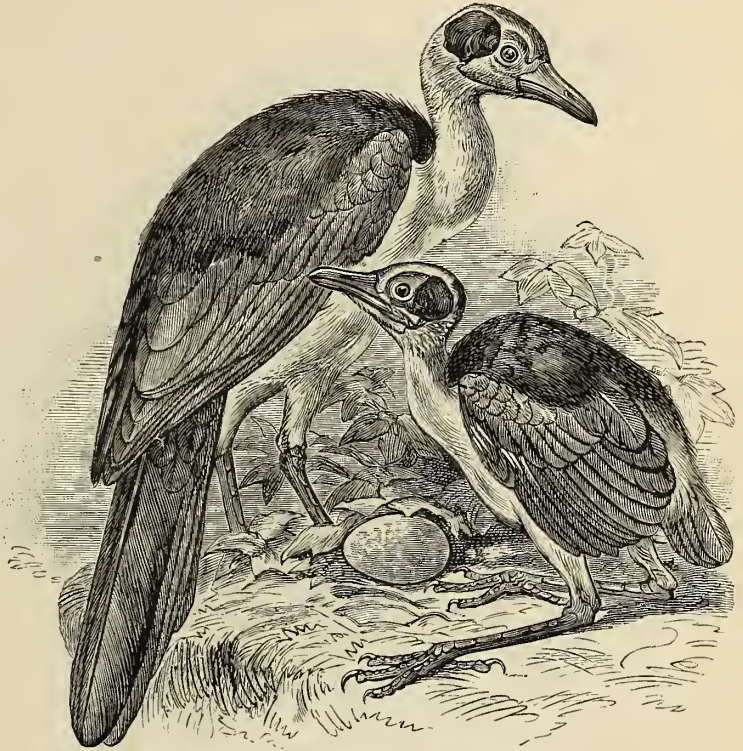
These are also inhabitants of Central and South America, and are little known. They are all birds of variegated plumage and of handsome appearance. The tail is rather lengthened, exceeding the wing in length. It is unfortunate that the name *Xanthura* (yellow-tailed) has to be adopted for them, as some of them have the tail blue. Indeed, only four out of fourteen species can be said to possess the yellow tail; and one of these, known as the Green Jay (*Xanthura luxuosa*), penetrates into Texas, and can therefore be considered as a North American bird. From the work of Messrs. Baird, Brewer, and Ridgway we cull a short note on the last-mentioned species:—"Colonel George A. McCall, Inspector-General of the United States Army, was the first person to collect these birds within our limits. He obtained them in the forests which border the Rio Grande, on the south-eastern frontier of Texas. There he found them all mated in the month of May, and he felt no doubt that they had their nests in the extensive and almost impenetrable thickets of mimosa, commonly called chapparal. From the jealousy and pugnacity which these birds manifested on the approach, or appearance even, of the large boat-tailed Blackbirds of that country (*Quiscalus macrurus*), which were nesting in great numbers in the vicinity, Colonel McCall was satisfied that the Jays were

* "History of North American Birds," Vol. II., p. 276.

at that time also engaged in the duties of incubation and rearing their young. In character and temperament these birds appeared to be very active and lively, though less noisy than some other species of the family. Their gay plumage was exhibited to great advantage as they flitted from tree to tree, or dashed boldly in pursuit of such of their more plainly-attired neighbours as ventured to intrude upon their domain."

THE BARE-NECKED CROW (*Picathartes gymnocephalus*).

To appreciate the peculiar appearance of this Crow, it should be seen either in a living state or preserved in spirits, because the bare skin of the head loses its colour in the dried specimens. The whole head and nape are bare, but, as will be seen by the wood-cut, there is a fleshy skin, of a bright yellow colour in life, which occupies the whole of it, excepting the sides of the hinder part of the skull and the ear-hole. This yellow skin passes over the occiput and joins the hinder neck, which is covered with a few bristly feathers. The upper surface is dark grey; the throat, sides of neck, and under surface white. The home of the Bare-necked Crow is the interior of the Gold Coast, where it is found only in the forests, and being considered *fetish* by the natives, is with great difficulty procured. The examples in the British Museum were obtained by the exertions of Governor Ussher, who, during his residence on the Gold Coast, employed a most intelligent native collector to penetrate into the interior for the purpose of collecting natural history specimens. This man affirmed that the birds were found in rocky forest grounds, generally in the neighbourhood of streams, building among rocks, and feeding on fresh-water shell-fish, snails, and reptiles. The native in question also procured the nestling and the egg. The latter is like that of many other Crows, and the nestling is coloured like the adult, having the bare head, and being dark grey above, white below, with remains of nestling down.



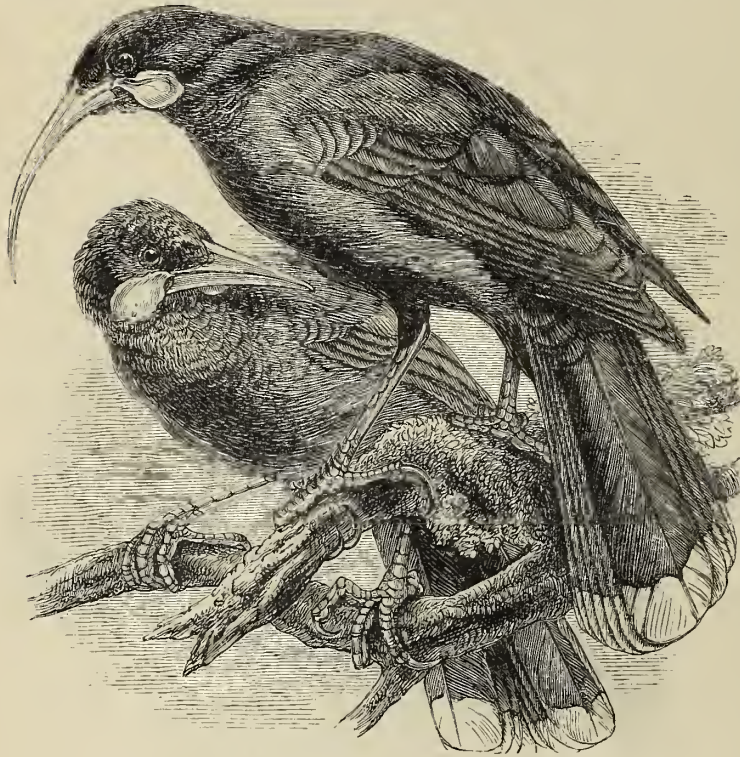
THE BARE-NECKED CROW. (After Keulemans.)

THE HUIA, OR NEW ZEALAND WOOD-CROW (*Heteralocha acutirostris*).

This very curious and aberrant Crow is a native of New Zealand, and is not found anywhere else. Even in that country it is very rare, and is becoming fast exterminated, like so many other New Zealand birds. The remarkable difference in the shape of the bill in the two sexes of the Huia led to the belief, for a long time, that these were two species; but it has since been proved that not only does the male have a very differently shaped bill from that of the female, but that this structural peculiarity serves a good purpose in the economy of the species. The best account of the Huia has been written by Dr. Buller, to whose pen we are indebted for the following extracts from his "Birds of New Zealand":—"Ere long it will exist only in our museums and other collections; and, for the sake of science, it is important that everything connected with its natural history should be faithfully recorded and preserved. In the absence of any published account of its

habits, beyond mere fragmentary notices, I have thought the subject of sufficient interest to justify my placing before the Society the following complete account of all that I have been able to ascertain respecting it. The peculiar habits of feeding, which I have described from actual observation, furnish to my own mind a sufficient 'reason' for the different development of the mandibles in the two sexes, and may, I think, be accepted as a solution of the problem.

"Before proceeding to speak of the bird itself, I would remark on the very restricted character of its habitat. It is confined within narrow geographical boundaries, being met with only in the Ruahine, Tararua, and Rimutaka mountain-ranges, with their divergent spurs, and in the intervening wooded valleys. It is occasionally found in the *Fagus* forests of the Wairarapa Valley, and in the



THE HUIA, OR NEW ZEALAND WOOD CROW. (After Keulemans.)

rugged country stretching to the westward of the Ruahine range, but it seldom wanders far from its mountain haunts. I have been assured of its occurrence in the wooded country near Massacre Bay (Province of Nelson), but I have not been able to obtain any satisfactory evidence on this point. It is worthy of remark that the natives, who prize the bird very highly for its tail-feathers (which are used as a badge of mourning), state that, unlike other species which have of late years diminished and become more confined to their range, the Huia was from time immemorial limited in its distribution to the district I have indicated.

"My first specimen of this singular bird (an adult female) was obtained in 1855 from the Wainuiomata Hills,

a continuation of the Rimutaka range, bounding the Wellington harbour on the northern side—the same locality from which Dr. Dieffenbach, nearly twenty years before, received the examples figured by Mr. Gould in his magnificent work, 'The Birds of Australia.' I have since obtained many fine specimens, and in the summer of 1864 I succeeded in getting a pair of live ones. They were caught by a native in the ranges and brought down to Manawatu, a distance of more than fifty miles, on horseback. The owner refused to take money for them; but I negotiated an exchange for a valuable greenstone. I kept these birds for more than a year, waiting a favourable opportunity of forwarding them to the Zoological Society of London. Through the carelessness, however, of a servant, the male bird was accidentally killed; and the other, manifesting the utmost distress, pined for her mate, and died ten days afterwards.

"The readiness with which these birds adapted themselves to a condition of captivity was very remarkable. Within a few days after their capture they had become perfectly tame, and did not appear to feel in any degree the restraint of confinement; for, although the window of the apartment in which they were kept was thrown open and replaced by thin wire netting, I never saw them make any attempt to regain their liberty. It is well known, however, that birds of different species differ widely in natural disposition and temper. The captive Eagle frets in his sulky pride; the Bittern refuses food, and dies untamable; the fluttering little Humming-bird beats itself to death against the

tiny bars of its prison in its futile efforts to escape ; and many species that appear to submit readily to their changed condition of life ultimately pine, sicken, and die. There are other species, again, which cheerfully adapt themselves to their new life, although caged at maturity, and seem to thrive fully as well under confinement as in a state of nature. Parrots, for example, are easily tamed ; and I have met with numerous instances of their voluntary return after having regained their liberty. This character of tamability was exemplified to perfection in the Huia.

“They were fully adult birds, and were caught in the following simple manner :—Attracting the birds, by an imitation of their cry, to the place where he lay concealed, the native, with the aid of a long rod, slipped a running knot over the head of the female and secured her. The male, emboldened by the loss of his mate, suffered himself to be easily caught in the same manner. On receiving these birds, I set them free in a well-lined and properly ventilated room, measuring about six feet by eight feet. They appeared to be stiff after their severe jolt on horseback, and after feeding freely on the huhu grub, a pot of which the native had brought with them, they retired to one of the perches I had set up for them, and cuddled together for the night.

“In the morning I found them somewhat recruited, feeding with avidity, sipping water from a dish, and flitting about in a very active manner. It was amusing to note their treatment of the huhu. This grub, the larva of a large nocturnal Beetle (*Prionoplus reticularis*), which constitutes their principal food, infests all decayed timber, attaining at maturity the size of man's little finger. Like all grubs of its kind, it is furnished with a hard head and horny mandibles. On offering one of these to the Huia, he would seize it in the middle, and at once transferring it to his perch, and placing one foot firmly upon it, he would tear off the hard parts, and then, throwing the grub upwards to secure it lengthwise in his bill, would swallow it whole. For the first few days these birds were comparatively quiet, remaining stationary on their perch as soon as their hunger was appeased. But they afterwards became more lively and active, indulging in play with each other, and seldom remaining more than a few moments in one position. I sent to the woods for a small branched tree, and placed it in the centre of the room, the floor of which was spread with sand and gravel. It was most interesting to watch these graceful birds hopping from branch to branch, occasionally spreading the tail into a broad fan, displaying themselves in a variety of natural attitudes, and then meeting to caress each other with their ivory bills, uttering, at the same time, a low affectionate twitter. They generally moved along the branches by a succession of light hops, after the manner of the Kokako (*Glaucopis cinerea*), and they often descended to the floor, where their mode of progression was the same. They seemed never to tire of probing and chiselling with their beaks. Having discovered that the canvas lining of the room was pervious, they were incessantly piercing it and tearing off large strips of paper, till, in the course of a few days, the walls were completely defaced.

“But what interested me most of all was the manner in which the birds assisted each other in their search for food, because it appeared to explain the use, in the economy of nature, of the differently formed bills in the two sexes. To divert the birds, I introduced a log of decayed wood infested with the huhu grub. They at once attacked it, carefully probing the softer parts with their bills, and then vigorously assailing them, scooping out the decayed wood till the larva or pupa was visible, when it was carefully drawn from its cell, treated in the way described above, and then swallowed. The very different development of the mandibles in the two sexes enabled them to perform separate offices. The male always attacked the more decayed portions of the wood, chiselling out his prey after the manner of some Woodpeckers, while the female probed with her long pliant bill the other cells, where the hardness of the surrounding parts resisted the chisel of her mate. Sometimes I observed the male remove the decayed portions without being able to reach the grub, when the female would at once come to his aid, and accomplish with her long slender bill what he had failed to do. I noticed, however, that the female always appropriated to her own use the morsels thus obtained.

“For some days they refused to eat anything but huhu ; but by degrees they yielded to a change of food, and at length would eat cooked potato, boiled rice, and raw meat minced up in small pieces. They were kept supplied with a dish of fresh water, but seldom washed themselves, although often repairing to the vessel to drink. Their ordinary call was a soft and clear whistle, at first prolonged, then short and quickly repeated, both birds joining in it. When excited or hungry, they raised their whistling note to a high pitch ; at other times it was softly modulated, with variations, or

changed into a low chuckling note. Sometimes their cry resembled the whining of young puppies so exactly as almost to defy detection."

SECOND SUB-FAMILY OF THE CROWS.—THE CHOUGHS (*Fregilinæ*).

In this sub-family, which contains only a few species, the bill is long and gently curved, and the nostrils are placed low down in the upper mandible. They are hidden by a dense tuft of bristles. In



THE CHOUGH.

England the sub-family is represented by the Red-billed or "Cornish" Chough, the same species which is alluded to in the old English glee—

"The Chough and Crow to roost are gone."

In Cornwall and the south-west of England the bird is no longer very plentiful, but is found on the rocky coasts of parts of Wales, the Hebrides, &c. In the mountains of Switzerland and Southern Europe the Alpine Chough (*Pyrrhocorax alpinus*) occurs, ranging as far as the Himalayas, and in Australia the sub-family is represented by the White-winged Chough (*Corcorax melanorhamphus*). A word, too, must be said about the curious Desert Choughs (*Podoces*), which inhabit Central Asia, where they are found only in the dreary sandy wastes and deserts which stretch from Bokhara to Eastern Tibet.

ORDER PASSERIFORMES: PERCHING BIRDS.

CHAPTER II.

BIRDS OF PARADISE—ORIOLES—DRONGOS—WOOD SHRIKES—CUCKOO SHRIKES—FLYCATCHERS.

THE BIRDS OF PARADISE—Variety of Plumage—Gaudily dressed Crows—Points in which they differ from the Crows—Two Sub-families—Mr. Wallace's Account of their Habits—Their History—The Great Bird of Paradise—The Smaller Bird of Paradise—Dr. Beccari on the Birds of Paradise of the Arafaks—THE ORIOLES—THE GOLDEN ORIOLE—Mr. Dresser's Description of its Habits—Size and Colour—THE DRONGOS—Distinctive Features—The Marquis of Tweeddale's Definition of the Family—THE WOOD SHRIKES—Mr. Gould's Account of the Pied Grallina—THE COMMON WOOD SHRIKE—THE CUCKOO SHRIKES—Habitat—Appearance—Mr. Gould on the Black-faced Cuckoo Shrike—Dr. Jerdon on the Common Indian Species—THE FLYCATCHERS—Characters—THE COMMON FLYCATCHER—Habits—THE FANTAILS—Mr. Gould's Account of the White-shafted Fantail and the Black Fantail—THE PARADISE FLYCATCHERS—THE RESTLESS FLYCATCHERS.

THE SECOND FAMILY OF THRUSH-LIKE PERCHING BIRDS.

THE BIRDS OF PARADISE (*Paradisiiæ*).

WITH the exception of the Humming-birds, there is no family which embraces so many peculiar and fantastically decorated forms as that of the Birds of Paradise. Every variety of plumage is met with in them, some having extraordinary plumes on the head, others being adorned with breast-shields, while many have the flank feathers produced to an inordinate length, so as even to hide the tail-feathers in some of the species. Strip them of their gorgeous plumage, and their true affinities become at once apparent, and they stand confessed as being nothing more than gaudily dressed Crows. Some of the Birds of Paradise—such as the Manucodes (*Manucodia*), or the Brown Birds of Paradise (*Lycocorax*)—exhibit even a Corvine appearance in their plumage, the latter birds being of a plain brown and black colour; but the whole family differ from the true Crows in the proportions of their feet, the outer toe being a little shorter than the middle one and longer than the inner toe, the hind toe, at the same time, being very large, and equalling the middle one in length. The family may be divided into two sub-families, the first of which may be called the Sickie-billed Birds of Paradise (*Epinachina*). All of these have a long curved bill, and include the Rifle Birds (*Ptilorhis*), the Twelve-wired Bird of Paradise (*Seleucidés*), and the Sickie-bills (*Drepanornis* and *Epinachus*). The second sub-family is that of the true Paradise Birds (*Paradisiiæ*). About thirty-four different kinds are known up to the present time, and the range of the family is included in a very small area: for, with the exception of the Rifle Birds and Manucodes, which are found in Australia as well as New Guinea, all the other members of the family are inhabitants of the latter island and the adjacent Moluccas, extending as far as the Batchian and Gilolo group. Science is indebted to Mr. A. R. Wallace for authentic information respecting the habits of the Paradise Birds, and the following extracts are taken from his well-known work on the Malay Archipelago. Writing in 1869, Mr. Wallace observes:—"As many of my journeys were made with the express object of obtaining specimens of the Birds of Paradise, and learning something of their habits and distribution, and being (as far as I am aware) the only Englishman who has seen these wonderful birds in their native forests, and obtained specimens of many of them, I propose to give here, in a connected form, the result of my observations and inquiries. When the earliest European voyagers reached the Moluccas in search of cloves and nutmegs, which were then rare and precious spices, they were presented with the dried skins of birds so strange and beautiful as to excite the admiration even of these wealth-seeking rovers. The Malay traders gave them the name of *Manuk dewata*, or God's Birds; and the Portuguese, finding that they had no feet or wings, and not being able to learn anything authentic about them, called them *Passaros de Sol*, or Birds of the Sun; while the learned Dutchmen, who wrote in Latin, called them *Avis paradiseus*, or Paradise Birds. John van Linschoten gives these names in 1598, and tells us that no one has seen these birds alive, for they live in the air, always turning towards the sun, and never lighting on the earth till they die; for they have neither feet nor wings: as, he adds, may be seen by the birds carried to India, and sometimes to Holland; but being very costly, they were then rarely seen in Europe. More than a hundred years later, Mr. William Funnell, who accompanied Dampier, and wrote an account of the voyage, saw specimens at Amboyna, and was told that they came to Banda to eat nutmegs, which

intoxicated them and made them fall down senseless, when they were killed by Ants. Down to 1760, when Linnæus named the largest species *Paradisea apoda* (the Footless Paradise Bird), no perfect specimen had been seen in Europe, and absolutely nothing was known about them. And even now, a hundred years later, most books state that they migrate annually to Ternate, Banda, and Amboyna; whereas the fact is that they are as completely unknown in those islands in a wild state as they are



THE TWELVE-WIRED BIRD OF PARADISE.

in England. Linnæus was also acquainted with a small species, which he named *Paradisea regia* (the King Bird of Paradise), and since then nine or ten others have been named, all of which were first described from skins preserved by the savages of New Guinea, and generally more or less imperfect. These are now all known in the Malay Archipelago as *Burong mati*, or dead birds, indicating that the Malay traders never saw them alive."

"The Great Bird of Paradise (*Paradisea apoda** of Linnaeus) is the largest species known, being generally seventeen or eighteen inches from the beak to the tip of the tail. The body, wings, and tail are of a rich coffee brown, which deepens on the breast to a blackish-violet or purple brown. The

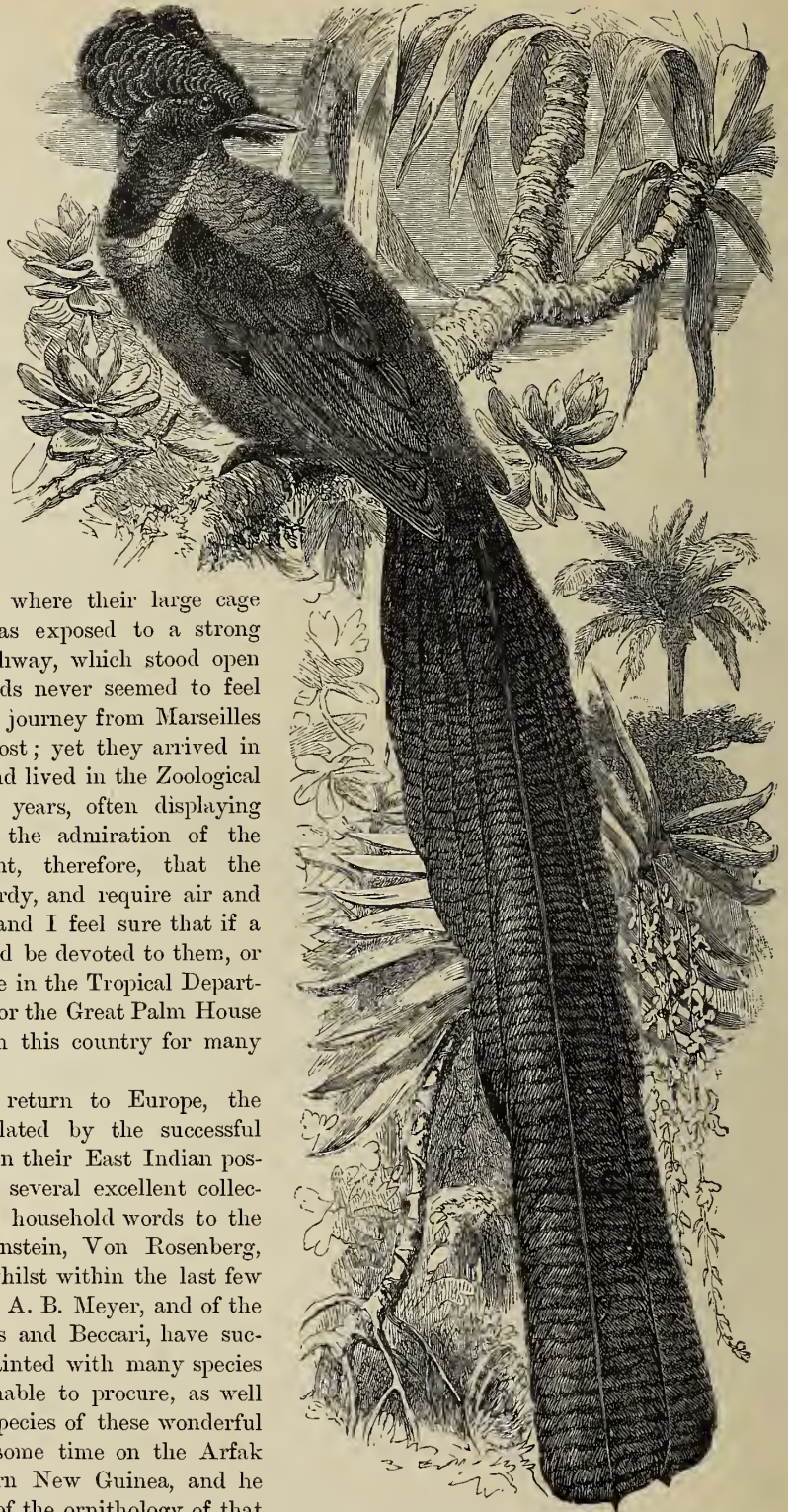
* *Apoda*, without feet.

whole top of the head and neck is of an exceedingly delicate straw yellow, the feathers being short and close set, so as to resemble plush or velvet; the lower part of the throat up to the eye is clothed with scaly feathers of an emerald green colour, and with a rich metallic gloss, and velvety plumes of a still deeper green extend in a band across the forehead and chin as far as the eye, which is bright yellow. The beak is pale lead blue; and the feet, which are rather large and very strong and well formed, are of a pale ashy pink. The two middle feathers of the tail have no webs, except a very small one at the base and at the extreme tip, forming wire-like cirrhi, which spread out in an elegant double curve, and vary from twenty-four to thirty-four inches long. From each side of the body, beneath the wings, springs a dense tuft of long and delicate plumes, sometimes two feet in length, of the most intense golden orange colour, and very glossy, but changing towards the tips into a pale brown. This tuft of plumage can be elevated and spread out at pleasure, so as almost to conceal the body of the bird. These splendid ornaments are entirely confined to the male sex, while the female is really a very plain and ordinary-looking bird of an uniform coffee brown colour, which never changes; neither does she possess the long tail wires, nor a single yellow or green feather about the head. The young males of the first year exactly resemble the females, so that they can only be distinguished by dissection. The first change is the acquisition of the yellow and green colour on the head and throat, and at the same time the two middle tail-feathers grow a few inches longer than the rest, but remain webbed on both sides. At a later period these feathers are replaced by the long bare shafts of the full length, as in the adult bird; but there is still no sign of the magnificent orange side plumes which, later still, complete the attire of the perfect male. To effect these changes there must be at least three successive moultings; and as the birds were found by me in all the stages about the same time, it is probable that they moult only once a year, and that the full plumage is not acquired till the bird is four years old. It was long thought that the fine train of feathers was assumed for a short time only at the breeding season, but my own experience, as well as the observation of birds of an allied species which I brought home with me, and which lived two years in this country, show that the complete plumage is retained during the whole year, except during a short period of moulting, as with most other birds. The Great Bird of Paradise is very active and vigorous, and seems to be in constant motion all day long. It is very abundant, small flocks of females and young males being constantly met with; and though the full-plumaged birds are less plentiful, their loud cries, which are heard daily, show that they also are very numerous. Their note is, '*Wauk-wauk-wauk-wök-wök-wök*;' and is so loud and shrill as to be heard at a great distance, and to form a most prominent and characteristic animal sound in the Aru Islands. The mode of nidification is unknown; but the natives told me that the nest was formed of leaves placed on an ant's nest, or on some projecting limb of a very lofty tree, and they believe that it contains only one young bird. The egg is quite unknown, and the natives declared they had never seen it; and a very high reward offered for one by a Dutch official did not meet with success. They moult about January or February, and in May, when they are in full plumage, the males assembling early in the morning to exhibit themselves in the singular manner already described. This habit enables the natives to obtain specimens with comparative ease. As soon as they find that the birds have fixed upon a tree on which to assemble, they build a little shelter of palm leaves in a convenient place among the branches, and the hunter ensconces himself in it before daylight, armed with his bow and a number of arrows terminating in a round knot. A boy waits at the foot of the tree, and when the birds come at sunrise, and a sufficient number have assembled and have begun to dance, the hunter shoots with his blunt arrow so strongly as to stun the bird, which drops down, and is secured and killed by the boy without its plumage being injured by a drop of blood. The rest take no notice, and fall one after another till some of them take the alarm."

Speaking of the smaller Bird of Paradise (*Paradisea papuana*), Mr. Wallace says:—"The true Paradise Birds are omnivorous, feeding on fruits and insects—of the former preferring the small figs; of the latter, grasshoppers, locusts, and phasmas, as well as cockroaches and caterpillars. When I returned home, in 1862, I was so fortunate as to find two adult males of this species in Singapore; and as they seemed healthy, and fed voraciously on rice, bananas, and cockroaches, I determined on giving the very high price asked for them—£100—and to bring them to England by the overland route under my own care. On my way home I stayed a week at Bombay, to break the journey and to lay in a fresh stock of bananas for my birds. I had great difficulty, however, in supplying them with

insect food, for in Peninsular and Oriental steamers cockroaches were scarce, and it was only by setting traps in the store-rooms, and by hunting an hour every night in the fore-castle, that I could secure a few dozens of these creatures, scarcely enough for a single meal. At Malta, where I stayed a fortnight, I got plenty of cockroaches from a bake-house, and when I left took with me several biscuit-tins full as provision for the voyage home. We came through the Mediterranean in March, with a very cold wind; and the only place on board the mail-steamer where their large cage could be accommodated was exposed to a strong current of air down a hatchway, which stood open day and night: yet the birds never seemed to feel the cold. During the night journey from Marseilles to Paris it was a sharp frost; yet they arrived in London in perfect health, and lived in the Zoological Gardens for one and two years, often displaying their beautiful plumes to the admiration of the spectators. It is evident, therefore, that the Paradise Birds are very hardy, and require air and exercise rather than heat; and I feel sure that if a good-sized conservatory could be devoted to them, or if they could be turned loose in the Tropical Department of the Crystal Palace or the Great Palm House at Kew, they would live in this country for many years."

After Mr. Wallace's return to Europe, the Dutch Government, stimulated by the successful result of his travels made in their East Indian possessions, despatched thither several excellent collectors, whose names are now household words to the ornithologist: such as Bernstein, Von Rosenberg, and Van Muschenbroek; whilst within the last few years the expeditions of Dr. A. B. Meyer, and of the Italian travellers D'Albertis and Beccari, have succeeded in making us acquainted with many species which Mr. Wallace was unable to procure, as well as in obtaining some new species of these wonderful birds. Dr. Beccari spent some time on the Arfak Mountains in North-western New Guinea, and he has written a long account of the ornithology of that wonderful region. From this essay a few sentences



GORGETED BIRD OF PARADISE.

are quoted, as they convey a very good idea of the charms which the traveller in New Guinea experiences on meeting the Birds of Paradise in a state of nature. "The Arfaks call the Gorgeted Bird of Paradise (*Astrapia gularis*) 'Haroma,' and the adult of the Great Bird of Paradise 'Kambiloja,' while the young ones and females are called 'Lessoa.' D'Albertis' Paradise Bird (*Drepanornis* albertisi*), named after the discoverer, is well known to the Arfaks under the name of 'Sagroja.' It is not very rare, but difficult to find, because, as the hunters assure me, it has no peculiar cry, so that it is only met with by chance. Its inconspicuous colour also makes it difficult to see. It is partial to places near recent clearings, from 3,000 to 5,000 feet, as it has the habit of flying to dead trees and fallen trunks, about which it finds the insects which form its food. In the stomachs of the two specimens I dissected I found only insects of various orders, ants predominating, and the larvæ of a lepidopterous insect. As to the Wattled Bird of Paradise (*Paradigalla carunculata*), I shot one from my hut while it was eating the small fleshy fruits of an *Urtica*. It likes to sit on the tops of dead and leafless trees, like Dumont's Grackle (*Mino dumonti*). The finest ornament of this bird are its wattles, which in the dried skin lose all their beauty. The upper ones, which are attached one on each side of the forehead, are of a yellowish-green colour; those at the base of the lower mandible are blue, and have a small patch of orange beneath. The Arfaks call the Paradigalla 'Happoa.' Of the Six-plumed Bird of Paradise (*Parotia† sexpennis*) I got one adult male alive, but it lived only three days. Its eye, with the iris azure, surrounded by a yellow ring, is extremely beautiful. The six feathers which ornament the head are not raised up vertically, but moved backwards and forwards in a horizontal and oblique direction, and are moved forward parallel to the sides of the beak. It is the commonest Paradise Bird on Mount Arfak; but, as usual, the adult males are much scarcer than the females and young males." "The superb Bird of Paradise is rather rarer than the *Parotia*; but I must tell you that the abundance of fruit-eating birds in a given locality depends principally on the season at which certain kinds of fruit are ripe; therefore, a species may be common in a place one month, and become rare or completely disappear in the next, when the season of the fruit on which it lives has passed. The magnificent Bird of Paradise (*Diphyllodes‡ speciosa*) is also pretty common, and easy to kill when one has learnt to know its song, which resembles a kind of *teia-teia-teia*, repeated several times with diminishing force. The sound produced by kissing the palm of the hand is a very good imitation. When once you have heard the song, if you approach carefully, especially early in the morning, you will find some small spaces, about a yard and a half in diameter, clear of sticks and leaves, where one or two males are paying court to a female. The males then erect all their feathers; the skin of the neck swells up like a bladder; the head seems like the centre of an aureola, which is formed beneath by the expanded feathers of the breast, and above by those of the yellow mantle, which are carried in a perfectly vertical position and spread like a fan. I kept a bird of this species alive for some days. It is found sometimes at a little distance from the sea on the plains, but perhaps more often on the hills, at 1,000 to 2,000 feet of elevation, preferring open spaces and the vicinity of streams."

THE THIRD FAMILY OF THRUSH-LIKE PERCHING BIRDS.

THE ORIOLES (*Orioliidae*).

The Orioles are generally of a bright yellow colour, with black wings, which contrast with and contrive to show off the golden tints of the plumage to the best advantage. They are all inhabitants of the Old World, and must not be mistaken for the Hang-nests of America (*Icteridae*), which often go by the popular name of Orioles also. The best known species of the family is

THE GOLDEN ORIOLE (*Oriolus galbula*).§

This species is a rare visitor to this country, but many instances of its occurrence have been recorded, and on one or two occasions it has been said to breed in England. It is found throughout Central and Southern Europe in summer, but does not extend very far north, and departs in winter to South Africa, where it is found in the Cape Colony, and occurs also in certain places on the east coast also. It is very common in Persia during the summer, and ranges eastwards to Central Asia.

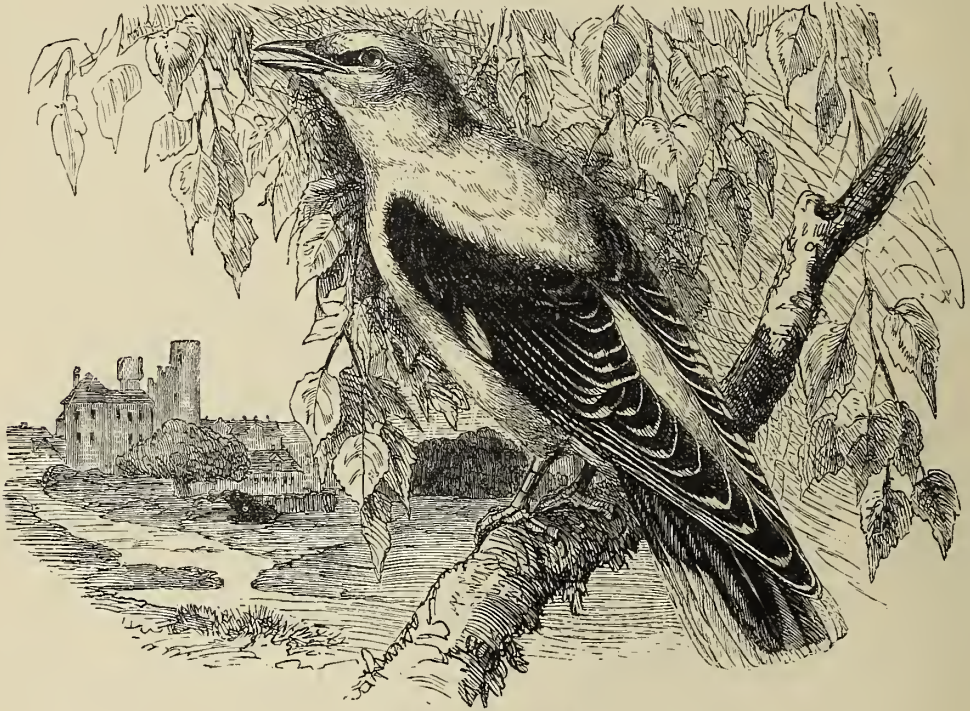
* δρεπάνη, a sickle; ὄρνις, a bird.

† παρωτίς, a curl by the ear.

‡ διφύλλος, two-leaved.

§ *galbus*, yellow.

One of the best accounts of the Golden Oriole is that given by Mr. Dresser in the "Birds of Europe," as it is a bird with which he is personally well acquainted. He observes, "The Golden Oriole is a shy and unobtrusive bird; and, in spite of its gaudy coloration, it is by no means a conspicuous or easily observed species. It affects evergreen groves and woods, where it keeps to the dense foliage, and appears to be a restless, uneasy bird, continually moving from place to place. When in Finland, now nearly twenty years ago, I had very ample opportunities of observing this species, for a pair bred in a garden, and were generally to be found in the high trees of a fine old avenue in front of the windows of the house in which I was living, and the clear bold whistle of the male and his mewing call could generally be heard. In spite of their being unmolested, they were shy, and used to hide amongst the dense foliage of the tree-tops, seldom descending into the bushes,



THE GOLDEN ORIOLE.

and were usually observed flying from one grove to another. I noticed that the flight was rolling and heavy, but swift; and they appeared to avoid taking long flights. I have since then seen the Golden Oriole in many countries, and have always found it a shy bird, difficult to observe or to approach. During the pairing season they may be observed chasing each other from grove to grove; and at that season especially it is a quarrelsome bird, not only as regards its own species, but it will chase away other birds that approach its chosen haunts. For any one who can closely imitate its note, it is no difficult matter to approach within a short distance of it, or rather, to entice it within range. Amongst the German foresters I have found many who can immediately entice an Oriole; but the bird has so good an ear that, although it will at first answer the call, it soon discovers the trick played on it, should a single note be false, and it is then hopeless to try and approach it. I can call this species tolerably well; but an old Oriole will generally find me out before he gets within range. Mr. Carl Sachse, however, is an adept at calling an Oriole; and I have been with him when he has enticed one within a few yards of the place where we were concealed. On one occasion he got three Orioles within range at the same time, which, considering the general wariness of this bird, is a tolerably good proof of his powers of mimicry. The note of the Oriole is a clear loud whistle, varied somewhat so as to resemble the syllables *huidleo*, *huitidleo*, *huidleo*, so clearly is the tone given. From its note many

of its local names, such as *Vogel Bülou*, *Schulz von Bülou* in Germany, and *Kuhankeitäjü*, as it is usually called by the Finnish peasants, are derived. Besides its clear whistle, it has a peculiar harsh mewing call-note; and its note of alarm is a harsh *chirr*. During the pairing season it utters what is apparently a note of affection, resembling the syllable *lio*, by mimicking which, together with its whistle, it can generally be enticed within range. Mr. Carl Sachse sends me the following note on its habits, as observed by him in Rhenish Prussia, viz:—‘With us it inhabits the groves where there are small ravines through which water flows, especially beech and oak groves, and where the undergrowth is dense. It arrives at rather irregular times, according to the season. It arrived earliest in 1863 and 1865, in both of which years it was seen as early as the 18th of April; whereas in 1875 the first was seen on the 5th of May. About the middle of August, or from then to the early part of September, it leaves us again; and, as may be almost taken for granted, it raises only one brood in the season. It is a wild, restless, quarrelsome bird; in the pairing season bitter encounters take place, and I have seen four or five together fighting in the air. Long before sunrise its clear flute-like note may be heard; but during the daytime it whistles less frequently. It ranges over a considerable tract; and hence its nest is hard to find, except when it breeds in the gardens. It may be enticed, by imitating its note, to within a few yards’ distance, but is hard to shoot, for it hops from twig to twig in the dense foliage, uttering its song in a low tone. Usually a male and a female arrive together; sometimes, however, three or four individuals; and then they immediately commence quarrelling.’ The food of the present species is varied according to the season of the year, but it is chiefly insectivorous when insect food is to be had, and more especially so in the spring, before any fruit is ripe. It devours all sorts of insects that inhabit the woodlands, but is especially fond of the large green caterpillars which are found on the leaves of the trees. It also feeds largely on berries and fruit when in season, but is not more destructive in a garden than many other birds, and amply repays any mischief it may do by the number of noxious insects it kills. It is most partial to cherries of all garden fruits, but will also feed on currants, and especially on mulberries. Mr. Sachse informs me that it often does much damage amongst the cherries; and when it has once or twice visited a cherry-tree, and finds the fruit to its liking, it may be shot, whilst feeding there, without much difficulty.”

The Golden Oriole is about nine inches in length, and is of a rich golden yellow colour, with black wings and tail; the primary coverts and the secondaries tipped with yellow, while all the tail-feathers have a broad yellow ending, which increases in extent on the outer feathers; between the nostril and the eye is a black spot; the bill is dull reddish, the feet leaden grey, and the iris blood red. The female when quite adult is like the male, but not quite so brilliantly yellow, the black being slightly shaded with greenish; the young birds are whitish beneath, with dusky streaks.

THE FOURTH FAMILY OF THRUSH-LIKE PERCHING BIRDS.

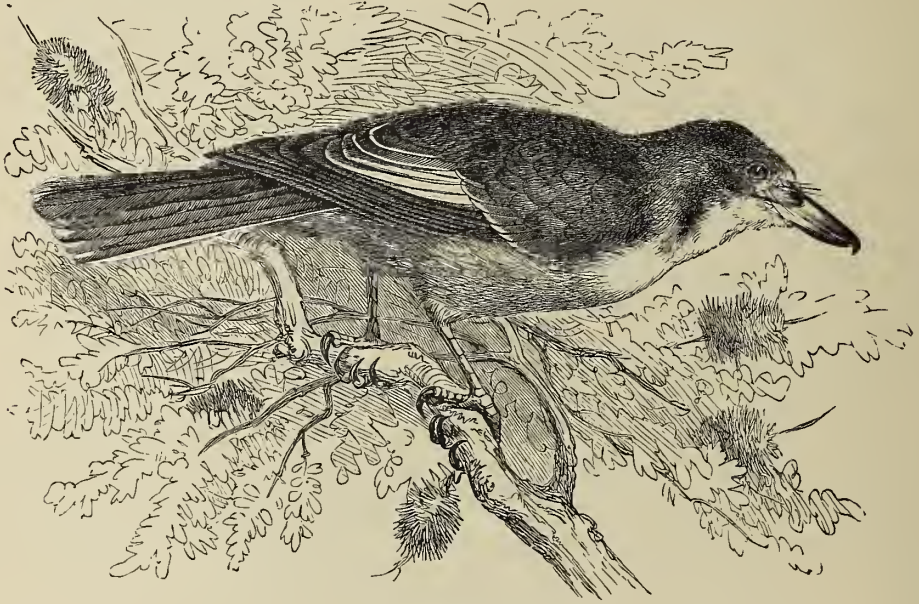
THE DRONGOS (*Dicruridæ*)*.

Although showing in some of their characters a certain affinity with the Orioles, the King Crows, or Drongos, as they are also called, are not far removed from the Flycatchers (*Muscicapidæ*), which they resemble, especially in having the nostrils entirely hidden by bristles. They differ, however, from all the Shrikes and Flycatchers in only having ten tail-feathers; and perhaps no better definition of the family could be found than that given by the Marquis of Tweeddale.† “The *Dicruridæ*,” he says, “constitute a natural, self-contained, sharply-defined family, which has its members ranging throughout the Æthiopian and Indian regions and the Austro-Papuan, including the Moluccas. One, and only one, appears to be migratory, *Buchanga leucogenys*, which reaches Japan in the summer months. As indicated by the form of the beak, the presence of strong rictal bristles, the short tarsus, short toes, and anchylosed first phalanges of the outer and middle toes, the *Dicruri* are Muscicapine in their affinities; and this relationship is unmistakably exhibited in their habits. All the species of which the ways have been recorded have the habit of descending from their perches to catch insects on the wing, and then immediately returning to the same or some adjoining place of rest. Some species—such as members of the genera *Bhringa*, *Chaptia*, *Dissemurmus*, and several of the genus

* *διρροος*, forked; *οὐρά*, a tail.

† Ibis, 1873, p. 69.

Buchanga—never descend to the ground, but capture their prey entirely on the wing. *Edolius forficatus*, according to Pollen ('Faune de Madagascar'), has similar habits. Those species that do descend to the ground, such as *Buchanga atra*, do so to seize their food, and remain only for a short time. This last-named species has the useful habit, where there are extensive plains of long dry grasses without suitable trees or bushes, of sitting on the backs of antelopes, sheep, cattle, &c., using them as beaters, and catching on the wing the insects disturbed by the feet of the grazing animals. The feet in all the *Dicruri* are essentially constructed for grasping, by which, together with the lengthened tail, walking is rendered difficult, if not altogether impossible. During a seven years' residence in India, I never once observed the common King Crow (*Buchanga atra*) move along the ground; and it is the most widely-spread and least specialised of all the Asiatic species. The flight of all is short, but rapid while it lasts."



THE PIED GRALLINA.

THE FIFTH FAMILY OF THRUSH-LIKE PERCHING BIRDS.

THE WOOD SHRIKES (*Prionopidae*).

These form a small group of birds whose affinities are not very easy to determine. In many cases the appearance and habits of the species are very much like those of the Flycatchers, but they all possess the chin-angle, reaching in front of the nostrils, to which allusion has already been made.* The members of this family are of somewhat varied form, and are found in Africa, India, Indo-Malayan regions, and Australia. One of the most remarkable of the Wood Shrikes is the Pied Grallina (*Grallina picata*) of Australia, which Mr. Gould places between the Crow Shrikes (*Craicticus*)† and the Cuckoo Shrikes (*Graucalus*); it is known by the names of Magpie Lark and Little Magpie to the Australian colonists, and is described by Mr. Gould in the following manner:—"Few of the Australian birds are more attractive or more elegant and graceful in their actions, and these, combined with its tame and familiar disposition, must ever obtain for it the friendship and protection of the settlers, whose verandahs and housetops it constantly visits, running along the latter like the Pied Wagtail of our own island. Gilbert states that in Western Australia he observed it congregated in large families on the banks and muddy flats of the lakes around Perth, while in the interior he met with it only in pairs, or at most in small groups of not more than four or five together. He further observes that at Port Essington, on the north coast, it would seem to be only an occasional visitant, for on his arrival there in

* See *ante*, p. 2.

† κρακτικός, noisy.

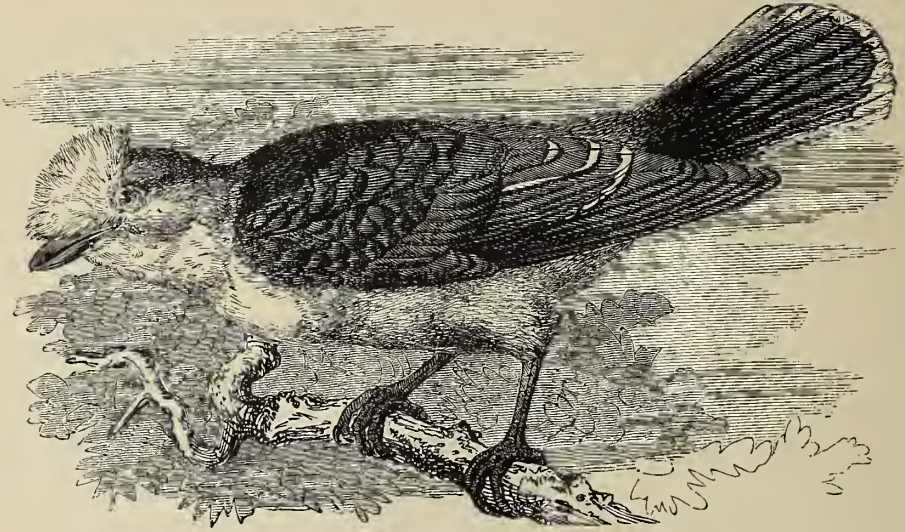
July it was tolerably abundant round the lakes and swamps, but from the setting in of the rainy season in November to his leaving that part of the country in the following March, not an individual was to be seen; it is evident, therefore, that the bird removes from one locality to another according to the season and the more or less abundance of its peculiar food. I believe it feeds solely upon insects and their larvæ, particularly Grasshoppers and Coleoptera. The flight of the Pied Grallina is very peculiar, unlike that of any other Australian bird that came under my notice, and is performed in a straight line, with a heavy flapping motion of the wings. Its natural note is a peculiarly shrill whining whistle, often repeated. It breeds in October and November. The nest is from five to six inches in breadth and three in depth, and is formed of soft mud, which, soon becoming hard and solid upon exposure to the atmosphere, has precisely the appearance of a massive clay-coloured earthenware vessel; and, as if to attract notice, this singular structure is generally placed on some bare horizontal branch, often on the one most exposed to view, sometimes overhanging water and at others in the open forest. The colour of the nest varies with that of the material of which it is formed. Sometimes the clay or mud is sufficiently tenacious to be used without any other material. In those situations where no mud or clay is to be obtained it is constructed of black or brown mould; but the bird, appearing to be aware that this substance will not hold together for want of the adhesive quality of the clay, mixes with it a great quantity of dried grass, stalks, &c., and thus forms a firm and hard exterior, the inside of which is slightly lined with dried grass and a few feathers. The eggs differ considerably in colour and shape, some being extremely lengthened, while others bear a relative proportion. The ground colour of some is a beautiful pearl white, of others a very pale buff; their markings also differ considerably in form and disposition, being in some instances wholly confined to the larger end, in others distributed over the whole of the surface, but always inclined to form a zone at the larger end. In some these markings are of a deep chestnut red, in others light red, intermingled with large clouded spots of grey, appearing as if beneath the surface of the shell. The eggs are generally four, but sometimes only two in number; their average length is one inch and three lines, and their breadth nine lines."

One of the best known forms belonging to this family is the genus *Teplodornis*,* which contains some half-a-dozen species, inhabitants of India and the Indo-Chinese countries, ranging down the Malayan Peninsula to the Sunda Islands. According to Dr. Jerdon, they go about in small flocks, which frequent thin jungle-groves, gardens, and even hedgerows, generally ranging from tree to tree, and most carefully hunting the branches for insects, chiefly *Coleoptera* and *Orthoptera*. The Common Wood Shrike (*T. pondicerianus*) has a mellow whistling note, and is said to be occasionally caged for its song. In Australia the Wood Shrikes are strongly represented by the genus *Collyriscincla*, of which Mr. Gould writes that "they are neither Shrikes nor Thrushes, but most nearly allied to the former, feeding on insects to a very great extent, but occasionally partaking of molluscs and berries. Some of them defend themselves vigorously when attacked. The nest is rather slightly built, cup-shaped in form, and is mostly placed in the hollow spout of a tree; the eggs are four in number." In Africa there are also several kinds of Wood Shrikes, the most peculiar being the Helmeted Wood Shrikes (*Prionops*).† Of *P. talacoma*, which is known as Smith's Helmet Shrike, Mr. C. J. Andersson gives the following note, in his "Birds of Damara Land":—"It is always seen in flocks of from half-a-dozen to a dozen individuals, which frequent secluded spots, where they restlessly hop from branch to branch on the bushes and the lower boughs of the trees, never remaining long on the same tree, but hunting most systematically for insects, which, with the occasional addition of young shoots and leaves, form their food. Whilst some individuals of the flock are examining a tree in search of insects, others keep moving slowly on, but rarely going farther than the next tree. When the locality is open, those which first reach a tree fix their gaze intently on the ground, and if any prey be in sight, pounce upon it with great celerity, their companions, whilst the successful preys are devouring their booty, continuing to move on slowly as before." Of Retzius' Helmet Shrike, which is also found in Damara Land, the same observer remarks:—"When encamped in the desert, a few days' journey south of the Okavango, I for the first and only time observed this fine Shrike. The flock consisted of six individuals—an adult male and female, and four young birds of both sexes—all of which I secured after much running and dodging, as they were

* τεφρώδης, ash-coloured; ὄρνις, a bird.

† πρῖων, a saw; ὤψ, a face.

exceedingly wary and watchful, always perching on the loftiest and most exposed trees: in which respect they differed from the preceding species, though they resembled it in the manner in which they were feeding when I first saw them."



THE HELMET SHRIKE.

GROUP II.—CICHLOMORPHÆ, THRUSH-LIKE PASSERES.

THE SIXTH FAMILY OF THRUSH-LIKE PERCHING BIRDS.

THE CUCKOO SHRIKES (*Campophagidæ*)*.

These birds are also known by the name of Caterpillar-catchers and Minivets, and are entirely peculiar to the Old World, but do not occur in the Palearctic region: that is to say, they are absent from Europe and Northern Asia; one species only, the Grey Minivet (*Pericrocotus + cinereus*), extending its range into the country of the Amoor in the eastern part of this region. In appearance these birds have much in common with the Shrikes, or rather, with the Wood Shrikes of the preceding pages; the bill, however, is always rather depressed or flattened, showing an approach to the true Flycatchers, but they are easily recognisable by the stiffened shafts of the rump-feathers, which gives this part a prickly feeling when the thumb is gently pressed directly on to the feathers of the lower back and rump. Very little has been recorded of the habits of the African or Indian species; but Mr. Gould has given a very interesting account of the Australian Cuckoo Shrikes. This continent, and the neighbouring islands of the Malay Archipelago, possess a large number of species; and of one of the largest, the Black-faced Cuckoo Shrike (*Graucalus melanops*), Mr. Gould writes as follows:—"It is a very common bird in New South Wales, but is far less numerous in winter than in summer, when it is so generally dispersed over the colony that to particularise situations in which it may be found is quite unnecessary: hills of moderate elevation, flats, and plains thinly covered with large trees, being alike resorted to; but I do not recollect meeting with it in the midst of the thick bushes—situations which, probably, are uncongenial to its habits and mode of life. It is very abundantly dispersed over the plains of the interior, such as the Liverpool and those which stretch away to the northward and eastward of New South Wales. Its flight is undulating and powerful, but is seldom exerted for any other purpose than that of conveying it from one part of the forest to another, or to sally forth in pursuit of an insect which may pass within range of its vision while perched upon some dead branch of a high tree, a habit common to this bird and other members of the genus. On such an elevated perch it sometimes remains for hours together, but during the heat of the day seeks shelter from the rays of the sun by shrouding itself amidst the dense foliage of

* κάμπη, a caterpillar; φαγείν, to eat.

† περί, round about; κροκωτός, saffron-coloured.

the trees. Its food consists of insects and their larvæ and berries, but the former appear to be preferred, all kinds being acceptable, from the large Mantis to others of a minute size. It breeds in October and the three following months. The nest is often of a triangular form, in consequence of its being made to fit the angle of the fork of the horizontal branch in which it is placed. It is entirely composed of small dead twigs, firmly matted together with a very fine, white, downy substance, like cobwebs, and a species of *lichen*, giving the nest the same appearance as the branch upon which it is placed, and rendering it most difficult of detection. In some instances I have found the nest ornamented with the broad, white, mouse-eared lichen. It is extremely shallow in form, its depth and breadth depending entirely upon that of the fork in which it is built; the largest I have seen did not exceed six inches in diameter. Its note, which is seldom uttered, is a peculiar single purring or jarring sound, repeated several times in succession."

In Africa the Grey Cuckoo Shrikes, such as that which has been described by Mr. Gould above, are only represented by two species, but the last-named continent possesses some peculiar metallic-plumaged birds, known as the Metallic Cuckoo Shrikes (*Campophaga*). These are replaced in the Himalayas and throughout the Indo-Malayan region by some duller-coloured species, whose prevailing tints are iron-grey. Of the common Indian species (*C. lugubris*) Dr. Jerdon writes:—"It is seen solitary or in small parties, frequenting high trees, the foliage of which it diligently searches for various insects. I have found caterpillars chiefly, also other soft insects, as well as bugs and beetles, but never berries, which Hodgson says it frequently eats. He also asserts that it freely descends to the ground to eat, which I certainly have never witnessed. It is a silent bird in general, but Hutton says it has a plaintive note, which it repeatedly utters while searching through a tree for insects. The same naturalist found its nest in the fork of a tree high up; it was small, shallow, made of grey lichens, roots, &c., and plastered over with cobwebs. The eggs were two, dull grey-green, with close streaks of a dusky brown." The Minivets belonging to the genus *Pericrocotus* are, with the exception of the Grey Minivet alluded to above, distributed over India, the Indo-Chinese countries, and the Malayan region. They are very different in appearance from the sober-plumaged Cuckoo Shrikes, the prevailing colours being black and scarlet, the latter being of such a dazzling hue as to render it painful to the eyes to examine them for long. The habits of these birds resemble those of the *Campophagæ*.

THE SEVENTH FAMILY OF THRUSH-LIKE PERCHING BIRDS.

THE FLYCATCHERS (*Muscicapidae*).

Any student following the descriptions of the last few families of birds with specimens in his hand would not have failed to notice that the bills were becoming more and more flattened, and that bristles were becoming a more marked feature of the basal portion of the bill. This latter character is the one by which a Flycatcher is generally recognised. The Scansorial Barbets, or *Capitonidae*, were very remarkable in this respect, but can be distinguished from Flycatchers in an instant by their zygodactyle foot. The Flycatchers are a very numerous family, comprising nearly three hundred species, all of very varied aspect but of very similar habits. Some of them resemble Shrikes; others, again, might be mistaken for Warblers; but a genuine Flycatcher is always to be told by the character of his bill mentioned above.

THE COMMON FLYCATCHER (*Muscicapa grisola*).*

About the time when the Cuckoo visits our shores a little brown bird also makes his appearance, coming, like the Cuckoo, from Africa, and departing again in the autumn, after having reared his young ones. This is the Common Flycatcher, who must be a familiar object to every dweller in the country, as he sits on the bare branch of a tree or on the rail of an iron fence, uttering his monotonous chirp, and flying without cessation after the passing insects, which he captures with unerring dexterity, and then again resumes his post of observation. As the Flycatcher feeds solely upon insect prey, it is a very useful little bird, and escapes the censure which is hurled at some of its less inoffensive relations; it is stated occasionally to feed on berries. It would appear to eject pellets formed of the hard portions of the insects it devours; and Mr. Bartlett, the Superintendent of the Zoological

* *Musca*, a fly; *capio*, I catch; *griseus*, grey.

Gardens in the Regent's Park, where the Common Flycatcher sometimes takes up its abode in summer, informed the writer that on one occasion he found the ground strewn with little blue pellets, which, on being examined, turned out to be the hard shells of the bodies of bluebottle flies, which had formed a large portion of the food of these birds. The nest is generally placed against a wall, or the trellis-work on a verandah, or on the side of a house, the last being a very favourite situation. The birds are very tame in their nature, and the female will often sit close while the nest is being inspected. When the young have flown, both parents labour to supply them with food; and the nestlings may often be seen perched in a row, and taking food in turn from the old ones. As they get older they will follow their parents about the trees; and it is at this time of year particularly that the Flycatchers somewhat abandon their habit of catching insects on the wing, and search for their food under the leaves of the trees. The Common Flycatcher is about five inches and a half in length; the wing three inches and a quarter; the general colour is dark brown, with lighter brown marks in the middle of each feather; the forehead hoary; the wings and tail darker brown, with pale margins to the secondaries and wing-coverts; the under surface of the body is white, with streaks of brown on the throat, breast, and flanks; the upper breast being washed with light brown, the flanks tinged with yellowish-brown, and the under wing-coverts and axillaries pale fawn colour.

Other species of true Flycatcher, very similar to our English bird, are found in Africa and in Eastern Asia; and like *M. grisola*, the Chinese Flycatcher is migratory, proceeding in winter to the Philippine Islands, and even to some of the Moluccas.

THE FANTAILS (*Rhipidura*).*

All the Fantails are remarkable for a very broad and wide-spreading tail, which spreads out like a fan when the bird is in motion. Commencing in India, the range of the genus extends through the Indo-Chinese countries, all over the Malayan Peninsula and the Malayan Archipelago, to Australia, and even to Oceania. The number of species is very large, and it is especially represented in the Malay Archipelago, where every little island or group of islands possesses a peculiar species. Mr. Gould gives an account† of the White-shafted Fantail (*Rhipidura albiscapa*) in Australia:—"In Tasmania I have seen the White-shafted Fantail, in the depth of winter, in the gullies on the sunny sides of Mount Wellington; and it is my opinion that it only retires at this season to such localities as are sheltered from the bleak south-westerly winds which then so generally prevail, and where insects are still to be found. The bird is also subject to the same law on the continent of Australia; but as the temperature of that country is more equable its effects are not so decided. And in support of this opinion, I may adduce the remark of Caley, who says: 'This species is very common about Paramatta, and I do not recollect having missed it at any period of the year.' It is generally found in pairs, but I have occasionally seen as many as four or five together. It inhabits alike the topmost branches of the highest trees, those of a more moderate growth, and the shrouded and gloomy foliaged dells in the neighbourhood of rivulets. From those retreats it darts out a short distance to capture insects, and in most instances returns to the same branch it had left. While in the air it often assumes a number of lively and beautiful positions, at one moment mounting almost perpendicularly, constantly spreading out its tail to the full extent, and frequently tumbling completely over in the descent; at another it may be seen flitting through the branches, and seeking for insects among the flowers and leaves, repeatedly uttering a sweet twittering song. This Fantail is rather a late breeder, scarcely ever commencing before October, during which and the three following months it rears two and often three broods. Its elegant little nest, closely resembling a wineglass in shape, is woven together with exquisite skill, and is generally composed of the inner bark of a species of *Eucalyptus*, neatly lined with the down of the tree-fern intermingled with flowering stalks of moss, and outwardly matted together with the webs of spiders, which not only serve to envelop the nest, but are also employed to strengthen its attachment to the branch on which it is constructed. The situation of the nest is much varied. I have observed it in the midst of dense brushes, in the more open forest, and placed on a branch overhanging a mountain rivulet, but at all times within a few feet of the ground. In its disposition this little bird is one of the tamest imaginable, allowing of a near approach without evincing the slightest timidity, and will even enter the houses of persons resident in the bush in pursuit of

* *πίρís*, a fan; *οὐρά*, a tail.

† "Handbook to the Birds of Australia," Vol. I., p. 238.



PARADISE FLYCATCHERS.

gnats and other insects. During the breeding season, however, it exhibits extreme anxiety at the sight of an intruder in the vicinity of its nest." Of the Black Fantail, or Wagtail Flycatcher of the colonists, the same author writes :—"With the exception of Tasmania, this bird has been found in every part of South Australia yet visited by Europeans. At the same time that it is one of the most widely diffused, it is also one of the most tame and familiar of the Australian birds, and consequently a general favourite. It is constantly about the houses, gardens, and stock-yards of the settlers, often running along the banks and close to the noses of the cattle, in order to secure the insects which are roused and attracted by the heat from their nostrils, along the roofs of the buildings, the tops of palings, gates, &c., constructing its pretty nest beneath the verandah, and even entering the rooms to capture its insect prey. It passes much of its time on the ground, over which it runs and darts with the utmost celerity ; and when skirting the stream, with tail erect and shaking from side to side, it presents an appearance very similar to that of the Pied Wagtails. The movements of the tails of the two birds, however, are very different, that of the European being perpendicular, while that of the Australian is a kind of lateral swing. Its song, which consists of a few loud and shrill notes, is continually poured forth throughout the entire night, especially if it be moonlight. Its flight is at times gracefully undulating, at others it consists of a series of sudden zigzag starts, but is always of very short duration. It never poises itself in the air, like the *Sisura inquieta*, and never mounts higher than the tops of the trees."

THE PARADISE FLYCATCHERS (*Terpsiphone*).

Like the Fantails, these Flycatchers have a very flat bill, which is bowed outwards, and then curves in towards the tip ; and in these two genera and a few allied ones are witnessed the most exaggerated form of a Flycatcher's bill. The Paradise Flycatchers have beautiful long tails, and the plumage in the adult males is generally pure white, while that of the females is chestnut. It takes some considerable time before the full white plumage is attained, and thus specimens in half plumage are extremely common in collections, as the males commence their life with a red plumage, like the female, and only gradually gain the white plumage of the adult. Dr. Jerdon describes the habits of the Indian Paradise Flycatcher (*Terpsiphone* paradisi*) as follows :—"In its habits it is restless and wandering, flitting continually from branch to branch and from tree to tree. It feeds chiefly on small flies and *Cicadelle*, almost always capturing them on the wing, sometimes picking one off a leaf or bough. I never saw it descend to the ground, as mentioned by Sykes. It is usually single or in pairs. Its flight is somewhat undulating, and it has a curious appearance on the wing, its long tail moving in jerks. I have heard no note, except a rather loud, harsh, grating cry of alarm. I have never seen its nest. Layard says that it makes a neat nest of moss and lichens, lined with hair and wool. The Ceylon names of the bird are Fire-thief and Cotton-thief respectively for the red and white birds. I have kept this Flycatcher alive for a few days in a closed room, and it used to be flitting about, catching flies and mosquitoes, the whole day. One flew on board a ship in which I was a passenger in the Bay of Bengal, between Madras and Vizagapatam, in October, 1836, and remained three or four days in the rigging. Blyth tells me that he has kept it for many months in a large aviary, where it subsisted on the flies which were attracted by the odour of the shrimps with which various small waders and others were daily supplied."

THE RESTLESS FLYCATCHER (*Sisura† inquieta*).

It is a curious fact that, although the Flycatchers are such a large family, the accounts of their habits are singularly monotonous, and present very little difference in this respect. The only person who has minutely noted the various characteristics of the different forms is Mr. Gould, and it is perhaps on account of the greater diversity of form which is met with in Australia. This fact must be the apology for the frequent quotations which are made in the course of this work from his "Handbook to the Birds of Australia." Before quitting the family it seems well to give the habits of the Restless Flycatcher, a very peculiar little bird, as detailed by the celebrated naturalist mentioned above. He writes :—"This species ranges over the whole of the southern portions of the Australian continent, and appears to be as numerous at Swan River as it is in New South Wales, where it may be said to be universally distributed, for I observed it in every part I visited, both

* τέρψις, joy ; φωνή, song.

† σείω, I shake ; οὐρά, a tail.

among the brushes as well as in the more open portions of the country, in all of which it is apparently a stationary species. It is a bird possessing many peculiar and singular habits. It not only captures its prey after the usual manner of the other Flycatchers, but it frequently sallies forth into the open glades of the forest and the cleared lands, and procures it by poising itself in the air with a remarkably quick motion of the wings, precisely after the manner of the English Kestrel (*Tinnunculus alaudarius*), every now and then making sudden perpendicular descents to the ground to capture any insect that may attract its notice. It is while performing these singular movements that it produces the remarkable sound which has procured for it from the colonists of New South Wales the appellation of 'The Grinder.' The singular habits of this species appear to have attracted the notice of all who have paid any attention to the natural history of New South Wales. Mr. Caley observes:—"It is very curious in its actions. In alighting on the stump of a tree it makes several semicircular motions, spreading out its tail at the time, and making a loud noise, something like that caused by a razor grinder at work. I have seen it frequently alight on the ridge of my house, and perform the same evolutions." To this I may add the following account of the actions and manners of this species, as observed by Gilbert in Western Australia:—"This bird is found in pairs in every variety of situation. Its general note is a loud, harsh cry, several times repeated. It also utters a loud clear whistle; but its most singular note is that from which it has obtained its colonial name, and which is only emitted while the bird is in a hovering position at a few feet from the ground. This noise so exactly resembles a grinder at work, that a person unaware of its being produced by a bird might easily be misled. Its mode of flight is one of the most graceful and easy imaginable. It rarely mounts high in flying from tree to tree, but moves horizontally, with its tail but little spread, and with a very slight motion of the wings. It is during this kind of flight that it utters the harsh note above mentioned, the grinding note being only emitted during the graceful hovering motion, the object of which appears to be to attract the notice of the insects beneath, for it invariably terminates in the bird descending to the ground, picking up something, flying into a tree close by, and uttering its shrill and distinct whistle."

CHAPTER III.

THE TRUE THRUSHES—THE WARBLERS—THE BABBLING THRUSHES—THE WRENS—THE BULBULS—THE BABBLERS—THE GRASS WARBLERS—THE AMERICAN BABBLERS—THE BUTCHER BIRDS—THE GREENLETS—THE TITMICE.

THE THRUSHES—Arrangement—First Sub-family—THE THRUSHES PROPER—Plumage of Young—Moulting of Adults—THE TRUE THRUSHES—Distribution—THE SONG THRUSH—Migration—How the Heligolandiers Catch them—Plans of Capture in Italy—Macgillivray's Description of the Bird in the Hebrides—Its Wonderful Song—Its Distribution—Flight—Food—Pairing—Nest—Plumage—THE BLACKBIRD—Macgillivray's Account of its Habits, Food, Flight, Pairing, and Song—Mr. Weir's Conjecture as to the Language of Birds' Song—Plumage—THE WARBLERS—Plumage of Young and Adult—THE COMMON NIGHTINGALE—Mr. Dresser's Account of the Species—Disposition—Song—Food—Habits—THE BABBLING THRUSHES—Characters—THE WRENS—THE COMMON WREN—Professor Newton's Description of the Hunting of the Wren—The Wren's Nest, as Described by Mr. Macgillivray—Colour and Size of Bird—THE BULBULS—Characters—Where Found—Dr. Jerdon on the Madras Bulbul—Captain Legge's Account of the Habits of the Species—THE TRUE BABBLERS—THE BUSH BABBLERS—Canon Tristram's Description of their Habits—THE BOWER BIRDS—THE REGENT BIRD—Mr. Gould on its Habits—Its "Bower" described—THE GRASS WARBLERS—THE COMMON FANTAIL WARBLER—Its Nest—How it is Constructed—Captain Legge's and Mr. Hume's Notes on the Subject—Habits of the African Species—Colour and Size of the Bird—THE TAILOR BIRD—Distribution—Call—Nest—THE AMERICAN BABBLERS—THE THRASHERS—Characters—The Brown Thrasher—Habits—Song—Disposition—Nest—THE MOCKING BIRDS—Audubon's Account of the Bird—His Love-Song—His Devotion to his Mate—The Young Birds—Nest—Eggs—Their Chief Enemies—Flight—Call—THE SHRIKES, OR BUTCHER BIRDS—Distinctive Features—The Great Grey Shrike—"Shrike's Larder"—Pertinacity in the Chase—Harsh Note—Colour and Size—THE GREENLETS—Mr. Gosse on the Jamaican Species—Their Peculiar Call—THE TITMICE—Characters—Sub-families—THE GREAT TITMOUSE, OR OX-EYE—Its Note—Its Nest—Colour and Size—The Long-tailed Titmouse—Their Beautiful Nest—Colour and Size—THE NUTHATCHES—Peculiar Nest—Habits—Size and Colour.

THE EIGHTH FAMILY OF THRUSH-LIKE PERCHING BIRDS.—THE THRUSHES (*Turdidæ*).

ACCORDING to the most recent arrangements, the Thrushes may be divided into two large sections, which in the present work are treated as sub-families, although Mr. Henry Seebohm, who has devoted

a great deal of study to them, believes that two great *families* ought to be recognised, the Thrushes and the Warblers.

THE FIRST SUB-FAMILY OF THE TURDIDÆ.—THE THRUSHES PROPER (*Turdinæ*).

The young in the first plumage are spotted on the upper parts as well as on the under parts. This plumage is completely moulted in the first autumn before migration; so that young in first winter plumage differ very slightly from adults. Adult birds have only one complete moult in the year, in autumn, before migration. The spring plumage is obtained by casting the ends of the feathers. There is no complete moult in the spring, only such feathers being renewed as have been accidentally injured. So far as we have been able to ascertain, these peculiarities are always in this group correlated with a plain tarsus.*

THE THRUSHES (*Turdus*).

Under the genus *Turdus* are comprised not only the Thrushes but the Blackbirds, as no difference can be discovered by which the latter can be separated under the genus *Merula*, though this has been done by many writers. As a rule Thrushes are spotted, and Blackbirds are uniform in coloration, but structurally they exhibit precisely the same form. In Europe, without counting a few Asiatic species which straggle within its eastern confines, we find the same species that are found in England distributed over the greater part of the continent, such as the Song Thrush, the Missel Thrush, the Fieldfare, the Redwing, the Blackbird, and the Ring Ouzel.

THE SONG THRUSH (*Turdus musicus*).

This familiar bird is found in England all the year round, but it is very doubtful if the individuals which inhabit England in the summer remain with us during the winter months. It is now some years ago since Professor Newton drew attention to the fact that a migration of the Song Thrushes is a common occurrence during the latter season of the year, and subsequent observations have only tended to confirm the truth of the statement. During the author's stay in Heligoland in the autumn, numbers of Thrushes passed over the island, and were caught in large numbers in the bushes which are erected by the inhabitants for this purpose in their gardens. A large row of sticks and bush is placed by them generally at the end of the little plots of ground, which are either rented from the Crown, or are the property of the Heligolanders themselves. Most of the ground is taken up by potato patches, that vegetable forming the staple food of the islanders during the winter; but a piece of grass is left for the support of the family sheep, whose milk is consumed in the place of cows' milk, there being no cows upon the island. The larger number of the Thrush bushes are found at the eastern end of the rock, close to the town and in the vicinity of the lighthouse, and are generally placed from east to west, as it is in this direction that most of the migrants arrive on the island. A large net is drawn along the back of the bushes, and in the early morning, before it is quite light, the owner visits his bush, and by suddenly clapping his hands startles the tired and sleeping birds, who fly to the opposite side of the bushes and are immediately entangled in the net. Owing to the scarcity of meat, which arrives in Heligoland from Hamburg only, and the supply of which is less certain during winter, the catching of Thrushes is a serious matter for the supply of the islander's table. In Belgium and other parts of Europe where a large migration of Thrushes takes place, vast quantities are caught during this period. In Italy, according to Count Salvadori, they are much esteemed for the table, and there are many modes of capturing them. In some places there are tracts of wooded ground which every year are arranged with birdlime and nets; and during the season on some mornings hundreds are caught. In the Maremma Toscana, men gain their livelihood by catching Thrushes and Blackbirds in snares, and each man looks after about three thousand snares. In Sardinia also large numbers are caught, boiled, and put into sacks with myrtle leaves, and are sold at high prices in the markets. "The Song Thrush," writes Macgillivray, "is associated in my memory with the Hebrides, where it is perhaps more abundant than in most parts of Britain. There in the calm summer evening, such as for placid beauty far exceeds any that I have elsewhere seen, when the glorious sun is drawing towards the horizon, and shedding a broad glare of ruddy light over the smooth surface of the ocean; when the scattered sheep, accom-

* Seebohm, "Ibis," 1879, p. 309.

panied by their frolicsome lambkins, are quietly browsing on the hill; when the broad-winged Eagle is seen skimming along the mountain-ridge, as he wends his way towards his eyry on the far promontory; when no sound comes on the ear save, at intervals, the faint murmur of the waves rushing into the caverns and rising against the faces of the cliffs; when the western breeze stealing over the flowery pastures carries with it the perfume of the wild thyme and white clover; the song of the Thrush is poured forth from the summit of some granite block, shaggy with grey lichens, and returns in softer and sweeter modulations from the sides of the heathy mountains. There may be wilder, louder, and more marvellous songs, and the Mocking-bird may be singing the requiem of the Red Indian of the Ohio, or cheering the heart of his ruthless oppressor, the white man of many inventions; but to me it is all-sufficient, for it enters into the soul, melts the heart into tenderness, diffuses a holy calm, and connects the peace of earth with the transcendent happiness of heaven. In other places the song of the Thrush may be lively and cheering; here, in the ocean-girt solitude, it is gentle and soothing. By its magic influence it smoothes the ruffled surface of the sea of human feelings, as it floats over it at intervals with its varied swells and cadences, like the perfumed wavelets of the summer wind. Here on the hill-side lay thee down on this grassy bank, beside the block of gneiss that in some convulsion of primeval times has been hurled unbroken from the fissured crag above. On the slope beneath are small winding plots of corn, with intervals of pasture, and tufts of the yellow iris. The coast is here formed of shelving crags and jutting promontories, there stretches along in a winding beach of white sand, on which the wavelets rush with gentle murmur. Flocks of Mergansers and dusky Cormorants are fishing in the bay; the white Gannets are flying in strings towards the ocean; the Rock Doves glide past on whistling pinions, and the joyous Starlings bound towards their rocky homes. Hark to the cry of the Corncrake, softened by distance, now seeming to come from afar, now louder, as if borne toward you by the breeze. It has ceased, but the Cuckoo calls to his mate from the cairn on the hill. Again all is silent. The streaks in the channel show that the tide is ebbing; a thin white vapour is spread over the distant islands; and beyond them the spirit wings its flight over the broad surface of the ocean, to where the air and the waters blend on the western horizon. But it is recalled by the clear, loud notes of that speckled warbler, that in the softened sunshine pours forth his wild melodies on the gladdened ear. Listen, and think how should you describe the strain so as to impress its characters on the mind of one who never heard it. Perhaps you might say that it consists of a succession of notes, greatly diversified, repeated at short intervals with variations, and protracted for a long time; that it is loud, clear, and mellow, generally sprightly, but at times tender and melting. You might add that two birds at a distance from each other often respond, the one commencing its song when the other has ceased; and that sometimes several may be heard at once, filling a whole glen with their warblings. Listen again, and say what does it resemble?

'Dear, dear, dear,
In the rocky glen;
Far away, far away, far away
The haunts of men.
There shall we dwell in love
With the lark and the dove,
Cuckoo and corn rail;
Feast on the banded snail,
Worm and gilded fly;
Drink of the crystal rill,
Winding adown the hill,
Never to dry.

With glee, with glee, with glee,
Cheer up, cheer up, cheer up; here
Nothing to harm us; then sing merrily,
Sing to the loved one whose nest is near,
Qui, qui, qui, kween, quip,
Tiurru, tiurru, chipiwi,
Too-tee, too-tee, chiu choo,
Chirri, chirri, chooec,
Quiu, qui, qui.'

"No more, pray: the Thrush's song is inimitable and indescribable. It is heard at all seasons in fine weather, but especially in spring and summer, particularly in the early morning and about sunset. But it is not in sunshine only that this gentle songster warbles its wild notes; for often in the midst of the thick rain it takes its stand in some sheltered spot, under the cover of a projecting crag or stone, and for hours perhaps amuses itself with repeating its never-tiring modulations. The Song Thrush, which is a resident species, is distributed over all parts of Scotland and England. In summer it prefers the woods and hill-sides, the bushy banks of streams, and sheltered places at some distance from human habitations, although in cultivated districts it often nestles in the orchards, gardens, and

hedges. In winter the individuals which had made the woods and glens their summer residence approach the houses and feed in the gardens and fields, or betake themselves to the rocky shores, where they find subsistence by breaking the whelks and other shell-fish. Although in the cultivated districts it is seldom seen unless among the bushes or hedges, it is capable of flying to a great distance, which it does in gentle curves, with quick flaps, intermitted at intervals, sometimes at a considerable height, but more frequently only so high as to clear the trees. Its flight is always rapid, and it selects its place with quickness, settling instantaneously. When on the ground, and in the attitude of observation, it drops its wings a little, keeps its tail nearly horizontal, and raises its head obliquely. On observing a worm or other object, it leaps briskly towards it, picks it up, or, if it has withdrawn, pecks at the earth until it has seized it. Its general mode of progression on the ground is by leaping.



THE SONG THRUSH.

When in a listless mood, it droops the tail and wings, draws in its neck, and ruffles its feathers. In this attitude it may often be seen perched on a tree, bush, or stone. Its food is chiefly found on the ground, and consists of snails, earth-worms, larvæ, coleoptera, hips, berries, and seeds of various kinds. *Helix aspersa*, *hortensis*, and *nemoralis* supply great part of its food in winter. It breaks the shells by raising them in its bill, and knocking them repeatedly against a stone. Large heaps of the shells thus broken may be seen by garden walls, and in pastures on the edges of thickets. In the Hebrides, where it frequents the shores in winter, it treats the *Turbo littoreus* and *Trochus comuloides* in the same manner; and of these shells the fragments may often be found under shelter of some stone or slab, to which the bird flies with its prey. Many years ago, having in the course of my littoral rambles in Harris, frequently heard a sharp sound like that of a small stone struck upon another, I endeavoured to discover its cause, but for a long time in vain, until at length, being one day in search of birds, when the tide was out, I heard the well-known chink, and standing still discovered at a distance, in a recess formed by two flat stones at the upper part of the shore, a bird moving its head and body alternately upwards and downwards, each downward motion being followed by the noise which had hitherto been so mysterious. Running up to the place I found a Thrush, which, flying off, left a whelk newly broken, but with the animal in it, lying amidst a heap of fragments round a smooth stone.

Having some years after mentioned the circumstance to a scientific friend in Edinburgh, I was favoured with an assurance of the utter impracticability of the feat, which indeed is at first mention not very credible, although one may easily satisfy himself that a whelk, thick as it is, is very easily broken by knocking it smartly against a hard body.

"The full song of this species is heard in April, May, and June, although, as I have already said, it may be occasionally heard at any season. In March it pairs, and by the end of that month, or in the beginning of the next, begins to construct its nest, which is placed in a thick bush of any kind, or in a hedge at a small height, or on a rough bank among shrubs or moss. In the unwooded parts of the country it is found under shelter of a projecting stone or crag, in the crevice of a rock, or at the root of a tuft of heath, or among the stunted willows on the rocky bank of a stream. It is composed externally of slender twigs, roots, grass, and moss, and is lined with a thin layer of mud, cow-dung, or rotten wood, neatly laid on, and between which and the eggs no other substance is interposed. The diameter of the cavity is usually about four inches, its depth from two and a half to four. As a good deal of wrangling has taken place on the subject of Thrushes' nests, I may be allowed to be somewhat particular in this matter. Although the structure of the nest does not vary much, the materials are very diversified. In a nest before me, which is very bulky, the exterior is formed of the long tough roots of various plants, a twig of *Rumex crispus* or *latifolius*, another of the rasp, a clipping of box wood, a piece of pack-thread, numerous tufts of *Poa annua*, and *Stellaria media*, two or three mosses, and some other substances. Within this is a more elaborate structure of fibrous roots, tufts of grasses, straws, and some beech-leaves, interwoven, and compacted with some tenacious substance. This inner cup is lined or plastered with a very thin but firm coating of what seems to be horse-dung, on the surface of which are spread numerous chips of straw and slender grasses, but certainly no decayed wood, as some allege to be usually the case. This nest is in diameter three inches and a half, in depth two and a half, its greatest diameter seven inches, and its greatest depth four and a half. This is the nest of a civilised Thrush, it having been found in a hedge in the immediate vicinity of Modern Athens.

"On the 5th of May, 1836, I found in a honeysuckle bush in a wood between Haddington and Gifford the nest of a Thrush, in which the bird was working at the time, completing its interior, in which was a piece of wet rotten wood, quite soft and friable, which it was applying to the walls. Another nest found near Gifford was plastered with horse-dung. One brought to me from Melville Woods, on the 3rd of May, 1837, by my son, who found in it five eggs, is composed externally of twigs, straws, and stems of herbaceous plants; its inner cup of a few slender twigs of trees, stems, and leaves of grasses, oak leaves, and a large proportion of mosses, interwoven and agglutinated, but without mud. The lining, which is not thicker than two-twelfths of an inch at most, is certainly composed entirely of fragments of rotten wood and other vegetable substances, without any mud, clay, or dung. Its internal diameter at the mouth is three inches and a half, but below the mouth four inches, the depth two and a half. In all the specimens which I have examined, the mouth of the inner cup is contracted and firmly woven. The eggs are generally five, but vary from four to six, of a regular or broad oval form, bright bluish-green, with scattered spots of brownish-black, of a roundish form, and more numerous at the larger end. They vary considerably in size, the largest in my collection measuring thirteen-twelfths by nine-and-a-half, the smallest, eleven-and-a-half by eight-and-a-half twelfths. They are deposited in the end of April, sometimes so early as the beginning of that month, and sometimes not until May. The young I have found abroad from the 20th of April to the middle of June. Another brood is generally reared in the season."

The Thrush is so well-known a bird that it hardly merits a separate description. The general colour above is olive-brown, the wing-coverts more or less distinctly tipped with spots of ochre; the wings and tail are like the back; the under surface is whitish with a fulvous tinge on the breast and sides; the ear-coverts, cheeks, fore-neck, chest, and flanks are all spotted with black; bill blackish-brown, yellowish at the base of the lower mandible; legs pale flesh colour, iris brown. The female is like the male, but young birds are mottled all over with ochraceous buff streaks on the feathers of the upper surface.

The under wing-coverts in the Common Thrush are of a rich golden colour, and are sufficient to distinguish the species at a glance from the nearly allied Redwing (*Turdus iliacus*), which is a

winter visitant to this country. Besides these two birds there are the Missel Thrush, a fine large species, which has of late years extended its range considerably in England, and the Fieldfare (*Turdus pilaris*), which come with the Redwing in the winter, and leave again before the summer begins. These four species constitute our regular British Thrushes, but there are one or two European and American species, which have also occurred within the limits of the British Islands.

THE BLACKBIRD (*Turdus merula*).

Although it is impossible to find any structural difference between a Thrush and a Blackbird, yet the usual sombre hue of the latter, which prevails not only in our own species, but in its allies throughout the world, seems to divide the Blackbirds off as a distinct group of the genus *Turdus*. Besides the species of true Thrushes mentioned above, England is inhabited by the common Blackbird and the Ring Ouzel, the former resident, and the latter entirely migratory. To quote once more from the delightful work of Macgillivray: "The Blackbird, which is one of the most admired of our native songsters, is a permanent resident, and occurs in almost all parts of England and Scotland, although it prefers the more cultivated districts, and is rarely met with in the centre and more elevated tracts. Being, properly speaking, an inhabitant of bushy places and woods, it does not breed in the northern and more remote Hebrides, nor in districts of the mainland destitute of sylvan vegetation. In winter it frequents the neighbourhood of houses and towns, resorting to woods, hedges, and gardens, and generally keeping in the shelter of trees or bushes. At this season its food consists principally of snails, especially *Helix aspersa*, and *H. nemoralis*, the shells of which it breaks by raising them in its bill, and dashing them against a stone or other hard surface. It also occasionally breaks them open by pecking against the spire, in which the shell is much thinner. Like many other birds, however, it has a large range of food. Thus, having opened five individuals, I found in the stomach of one a great quantity of seeds and husks of gramina, including wheat and oats; in that of another, coleopterous insects; in that of a third, coleoptera, and seeds of various kinds; in that of the fourth, mollusca and fragments of shells; in that of a fifth, seeds, mullusca, and a few grains of gravel, earthworms, larvæ, berries, and seeds of various kinds. It is amusing to observe a Blackbird searching for food on the smooth green of a garden, which one may easily do from the window without being noticed. In December, 1832, I watched one in order to note its motions. After looking quietly at a particular spot for some time, it hopped up, began to peck the ground with great energy, and after some exertion succeeded in dragging out a worm of moderate size, which it immediately threw on the ground. It then pecked at the worm for nearly a minute, and, beginning at one end, separated by a sudden stroke a small portion, which it swallowed. In this manner it proceeded until it had devoured the whole, not swallowing at any time more than a small fragment. It then hopped about, looking now and then attentively at a certain spot, and at length began to dig vehemently for another worm, which it soon procured. This was the first time that I had closely watched a Blackbird while searching for worms; but I have since had repeated opportunities of convincing myself that it always proceeds in the same manner, never swallowing an entire worm unless it happens to be extremely small, and cutting the very large ones into a great number of pieces. The sides of walls and hedges are favourite places of resort, for there it readily procures worms and snails. In hard weather it often eats the berries of the hawthorn, which it swallows whole, and betakes itself to the corn-yards, where it picks up seed chiefly on the ground. When searching for food, it hops or leaps with great alacrity, keeping its tail a little raised and its wings loose; and when perched on a tree, twig, or wall, it generally elevates its tail, unless disposed to doze, in which case it draws in its neck, ruffles its plumage, tucks up its wings, and allows the tail to droop. When disturbed, it flies off uttering a loud chuckling noise, which, although clear and shrill, reminds you of the chatter of the Magpie; and you may pursue it from one part of a hedge to another, until you obtain it, for it seldom shifts to a great distance. Although thus easily procured, it is yet decidedly shy, and in this respect differs greatly from the Song Thrush, which imagines itself secure at a very short distance. The flight of the Blackbird over an open space is steady, without undulations; but along the hedges is wavering and fitful, and the bird suddenly darts into the place which it selects, and instantly settles. During the breeding season its flight is peculiar, for then the female especially moves through the air as if by starts, performing a single flap, followed by a considerable interval, and



THE BLACKBIRD.

then continuing its course. The Missel Thrush, the Fieldfare, and the Redwing frequently take long flights, and are often seen advancing at the height of several hundred yards; but the Blackbird rarely ventures on a long excursion, but prefers skulking, as it were, among the hedges and trees. Compared with the Song Thrush, it is a very lively bird, and it is amusing to observe one that has just alighted on a twig; and see how gracefully it bends forward, throws up its tail, jerking it at intervals, depresses and at intervals flaps its wings, and then perhaps flits to another branch, where it performs the same motions, or alights on the wall, hops along, suddenly stops, jerks its tail, flaps its wings, and then commences singing.

"Even in severe weather in winter Blackbirds are not gregarious; and on no occasion have I seen more than three or four together, and that only for a few minutes. Although a male and a female may sometimes associate during that season, it is much more common to find them solitary. Nor does this species cherish the society of any other, though it may be seen in the vicinity of a Song Thrush, a Hedge Chanter, or other small bird. While the Fieldfares and Redwings cover a field in search of food, the Blackbirds very seldom venture amongst them, but prefer the shelter of the fences. The female is less clamorous than the male, who, on being alarmed or irritated, especially in the breeding season, emits a loud clear chuckling cry, in some degree approaching to the chatter of the Magpie, fluttering or flapping its wings, and bending its body forward at the same time. This remarkable cry, variously modulated by different individuals, sometimes exhibits a slight resemblance to the cackle of a domestic hen after laying; but whether it be the same as that alluded to by a correspondent in the 'Naturalist,' as similar to the crowing of a cock, and by the editor of that journal as resembling the notes of several varieties of that species, I am unable to determine, not having listened to the individuals mentioned by them. This much, however, I have observed, not as a singular circumstance, nor even as one common to a few individuals, but as exhibited at all seasons, at the period of breeding, and in the middle of winter, and by very many birds of the species, that the male, on perching, whether on a tree or on the ground, but especially on the former, raises his tail, flutters, it might almost be said, flaps his wings, emits his chuckling cry, and continues balancing himself, or hops along, repeating the notes, which, should he be alarmed, or in any way excited, are sometimes raised and prolonged, so that a person fond of tracing affinities and analogies might naturally enough liken it to the crowing of a cock.

"It is not in the wild valley, flanked with birchen slopes, and stretching far away among the craggy hills, that the music of the Blackbird floats upon the evening breeze. There you may listen delighted to the gentle song of the Mavis; but here, in the plain, covered with cornfields, and skirted with gardens, sit thee down on the green turf by the gliding brook, and mark the little black speck stuck, as it were, upon the top twig of that tall poplar. It is a Blackbird, for now the sweet strain, loud, but mellowed by distance, comes upon the ear, inspiring pleasant thoughts, and banishing care and sorrow. The bird has evidently learnt his part by long practice, for he sings sedately and in the full consciousness of superiority. Ceasing at intervals, he renews the strain, varying it so that although you can trace an occasional repetition of notes, the staves are never precisely the same. You may sit an hour, or longer, and yet the song will be continued; and in the neighbouring gardens many rival songsters will sometimes raise their voices at once, or delight you with alternate strains. And now, what is the purpose of all this melody? We can only conjecture that it is the expression of the perfect happiness which the creature is enjoying, when, uncared by care, conscious of security, and aware of the presence of his mate, he instinctively pours forth his soul in joy and gratitude and love. He does not sing to amuse his mate, as many have supposed, for he often sings in winter when he has not yet mated; nor does he sing to beguile his solitude, for now he is not solitary; but he sings because all his wants are satisfied, his whole frame glowing with health, and because his Maker has gifted him with the power of uttering sweet sounds."

"That some of the notes of birds," writes Mr. Weir, "are a language which conveys a direct meaning, may, I presume, be inferred from the following interesting occurrence, which took place at half-past three o'clock, an occurrence which I witnessed with the most anxious curiosity, and which I could scarcely have believed had I not seen it. The female having brought a large worm, I am sure more than four inches in length, put it into the mouth of one of the young, and then flew away. Upon her return, having perceived that it was sticking in its throat, she set up a moan of distress. To her

assistance her cry immediately brought her partner, who likewise seemed to be aware of the consequences. To force it down they made several efforts, but in this they were unsuccessful. Strange to tell, the male at length discovered the cause of the catastrophe. The part of the worm which by being entangled among the feathers of the breast had been prevented from going down, he carefully disengaged, and held it up with his bill, until, after the most unusual efforts, the young bird at length swallowed it. But so much exhausted was it that it remained for nearly three hours without moving, and with its eyes shut. The male, having alighted upon a tree a few yards from his nest, poured forth some of his most enchanting notes, a song of rejoicing, no doubt, for the narrow escape from death which one of his family had just made."

The Blackbird, as its name implies, is entirely black, with an orange bill, and a ring of orange round the eye. The female is brown, with a dark-brown bill; more or less rufous on the throat and breast, which have black stripes. Varieties are often met with, especially some with white feathers distributed among the black plumage, but these are not to be confounded with the Ring Ouzel (*Turdus torquatus*), which is a summer visitant to England, and is distinguished by the broad white collar on the breast. The latter bird has also a very distinct winter plumage, when the black feathers are broadly edged with greyish-white. It should be added that very old Blackbirds have the feathers of the hind neck tipped with fine hairs.

Besides the true Thrushes, the sub-family Turdidæ includes the Chats, represented in England by the Wheatear, and the Redstarts.

THE SECOND SUB-FAMILY OF THE TURDIDÆ, OR THRUSHES.

THE WARBLERS (*Sylviinæ*).

The young in first plumage are unspotted on the upper parts (except in those cases where the adult birds are so also), and only in rare instances are traces of spots to be found on the breast. The adult birds moult twice in the year, in spring and autumn, both moults being complete. Birds in first plumage, having an opportunity of moulting in spring, do not require to moult in the first autumn, and only renew a few feathers then. Consequently, there is frequently a difference, principally in the colour of the under parts, between the young and the adult in winter plumage. So far as can be ascertained the characters assigned to the Warblers are always associated with a scutellated tarsus.*

THE COMMON NIGHTINGALE (*Daulias luscinia*).

This, the most favourite Warbler of ancient and modern times, is a summer visitor to England, retiring in winter to northern Africa, and even penetrating as far as the Gold Coast, in western Africa. Mr. Dresser gives the following account of the species in his work on the "Birds of Europe":—

"This, the best known and most highly esteemed of our songsters, is essentially a bird of the woodlands, and is always found in the groves or woods on the plains, never in the mountains, or in conifer woods, but in tolerably low, non-evergreen growth, where there is a fairly abundant undergrowth, and where the soil is rather damp, or where damp ditches or water is not far distant. It is a very unobtrusive bird; and although the song of the male may be heard daily, it is astonishing how seldom a casual observer obtains a glimpse of the bird itself. The males arrive first in the spring, and appear to be weary and travel-worn when they first appear; but they soon recuperate, and when, after the lapse of a few days, the females commence to appear, they have recovered their usual sprightliness and soon break out into their matchless song, which may be heard until the young are hatched. The song of this bird is, with justice, considered to be the richest and most melodious of all our songsters; and it is impossible to reproduce its notes in words so as to give any idea of it. No bird has so varied and sweet a song, and it is so rich and full that one is astonished that it can be produced by so small a bird. There is, however, much individual difference in the quality of the song of birds from different localities, as is well known by all the bird fanciers, especially by the Germans; and Naumann remarks that those from Pomerania are the worst songsters, whereas those from Wörlitz in Anhalt Dessau are the best he ever heard. As a rule, the Nightingale is not a shy bird; and far from shunning the presence of man, it appears in preference to take up its abode somewhere in the vicinity of inhabited places. Nor is it a quarrelsome bird towards others of its own species, except during the

* Seebohm.

pairing season, when frequent disputes occur amongst the males. It usually frequents the lower branches of the trees, or the bushes, where it does not move about much, but sits with the wings rather drooped; and when it moves it usually flirts its tail, which when the bird is sitting is held in an almost horizontal position. When on the ground it carries the body erect, and looks very long-legged. It progresses by means of long jumps, and after taking ten or a dozen it usually stands still, pauses for a moment, as if thinking of what is next to be done, and then, with a flirt of the tail, hops on again. Its food, which is chiefly picked up from the ground, consists of worms, insects, and especially of insect larvæ; and it frequently searches for insects in old rotten timber and moss. It is also said to be very fond not only of the larvæ of ants (or so-called ants' eggs) but also of the ants themselves. Naumann says that it is partial to currants, both red and black, when ripe, and is very fond of elder-berries. Insects, however, are its staple food, and its partiality for a meal-worm renders it an easy victim to the bird-catchers. Large numbers are trapped every season, but few survive; for it is certainly one of the most difficult species to keep in confinement. Most of the birds are caught soon after they arrive, and but comparatively few of these are females. According to Harting, in the year 1867 three London bird-catchers, between April 13th and May 2nd, took two hundred and twenty-five Nightingales, all, except some half-a-dozen, cock birds. The previous year, the same men supplied the dealer who employed them with two hundred and eighty Nightingales, of which not more than sixty were hens. When both males and females have arrived from the south they soon commence nidification, and appear to resort to their old breeding localities. At first, not a few conflicts for the possession of their coveted locality take place, but when they have all selected their mates, each pair seem to settle down quietly in a suitable place; and then they live in amity together, though each pair assert the right of possession in their own small domain. The site for the nest is selected in a garden where the hedges are thick, or in a well-shaded lane, or else in a wood where the underwood is not too dense, and where the grass and low growth are thick in places. The nest is placed either on or close to the ground, in the latter case usually not more than a foot or so high, in a bunch of twigs, in an old tree-trunk, or in a dense hedge or bundle of faggots. The structure is composed, outside, of dry leaves, usually of the oak, inside which are a few dry bents, and sometimes rushes, or even fine flags; and the cup is carefully lined with fine roots and bents, and occasionally a little horsehair is added. The eggs, from four to six in number, are deposited in May, only one brood being raised in the season. They are uniform deep olive-brown in colour, sometimes with a greenish tinge, and occasionally tinged with reddish-brown, on a greenish-blue, or an olive-green surface, which is sometimes entirely, and sometimes only partially, exposed; and not unfrequently the brown is collected at one end of the egg. In size they vary from about $\frac{3.5}{10}$ by $\frac{2.7}{10}$ by $\frac{2.2}{10}$ inch. When the young are hatched the male ceases its song, and appears to devote its time to procure food for its offspring. Should danger threaten, a single loud croak is uttered as an alarm note, occasionally accompanied by a snapping of the bill. Its usual call-note is a clear, somewhat prolonged *wid* or *weed*; and pleasure is expressed by a deep note like *tack*. Its flight is swift and light, but it usually flies only short distances from bush to bush, and during the day-time at least it never seems to fly across any large open space; yet its power of flight must be by no means inconsiderable, as it traverses considerable distances on passage."

Besides the Nightingale, which has been selected as a typical Warbler, all the Whitethroats, and Sedge and Reed Warblers, are included in the sub-family *Sylviinæ*, besides a great number which are not found in the British Isles.

THE NINTH FAMILY OF THRUSH-LIKE PERCHING BIRDS.

THE BABBLING THRUSHES (*Timeliinæ*).

These birds constitute a large family, the exact limits of which it is by no means easy to define, but they possess one character which distinguishes them, and that is their rounded and concave wing, which is so formed as to fit close to the body. On being opened, or rather, parted from the side of the body, the arc described by the wing goes far towards the formation of a letter S; and in order fully to appreciate this characteristic, the wing of a true Thrush requires to be compared with that of a thoroughly typical Babbler. Thus, for instance, the wing of the Common Thrush is long and almost flat, its concavity being scarcely perceptible. A further mark of a true Thrush—with which are to be associated the Warblers and Chats—is the possession of a small bastard primary, the second quill being immensely long in comparison, and approaching the longer ones in dimensions. All these birds which



THE COMMON NIGHTINGALE.

possess this wing are powerful migrants. The *Timeliidæ*, on the other hand, with their feeble rounded wings, in which the bastard primary of the true Thrush is replaced by a broad first quill, are very poor fliers, and consequently, for the most part, stay-at-home or non-migratory birds. In this large family will be found several diverging elements: thus in some of the true Babbling Thrushes an approach is seen to the *Muscicapidæ*, or Flycatchers, while the Wrens (*Troglodytinæ*) and the Grass Warblers (*Cisticolinæ*) lead the student to the Titmice on the one hand and to the true Warblers on the other. The true Thrushes are approached by the Babbling Thrushes and the Bulbuls.

THE FIRST SUB-FAMILY OF THE TIMELIIDÆ.—THE WRENS (*Troglodytinæ*).

These are nearly all birds of small size, inhabiting the northern and temperate parts of both the Old and New Worlds. They differ from the rest of the Babblers in having scarcely any perceptible notch in the bill, which is rather long and curved; the tail is in general short in proportion to the body. The type of the family is

THE COMMON WREN (*Troglodytes parvulus*).

With the exception of the Gold-crest, this is the smallest English bird: it is generally distributed throughout the whole of Europe, and ranges as far as Central Asia. In England it is a general favourite, and, like the Robin, is accorded a certain amount of protection; and to many readers the old couplet about the "Robin and the Wren being God's cock and hen" will occur. It is difficult, therefore, to account for the persecution to which the species was formerly subjected in certain parts of Great Britain and even in France. Professor Newton* writes:—"The curious custom of 'hunting the Wren' has been mentioned by many writers; but little can be added to the accounts of it given by the late Sir Henry Ellis, in his notes to Brand's 'Popular Antiquities,' and by Thompson, though, from its practice obtaining in countries far apart, it is most likely of much greater antiquity than has been often supposed. It seems to have been first noticed by Charles Smith, in his 'State of the County of Cork,' published in 1750, as followed in the South of Ireland, and subsequently by Vallancy ('Collectanea de Rebus Hibernicis'). On Christmas Day boys and men, each using two sticks—one to beat the bushes, the other to fling at the bird—went out in a body to hunt and kill the Wren, which, from its habit of making but short flights, was no doubt soon done to death. On the following day, the feast of St. Stephen, the dead bird, hung by the leg between two hoops, crossed at right angles and decked with ribbons, was carried about by the 'Wren-boys,' who sang a song beginning, 'Droelin, Droelin, ri an teum' (that is, 'Wren, Wren, king of birds'), and begged money 'to bury the Wren.' This ceremony, which, however it may have arisen, had become quite senseless, was, when Thompson wrote, falling into disuse, and in 1845 the then Mayor of Cork, by proclamation, forbade its continuance. Mr. Halliwell ('Nursery Rhymes') notices the same practice in the Isle of Man, and gives the words there sung; while on February 4th, 1846 (as appears by the *Literary Gazette*, p. 131, of the 7th of that month), Mr. Crofton Croker drew attention to the subject at a meeting of the British Archaeological Association, and it was stated that a similar custom existed in Pembrokeshire, where on Twelfth Day a Wren was carried from house to house in a box with glass windows surmounted by a wheel, to which ribbons were hung. Sonnini ('Voyage dans la haute et la basse Egypt') mentions a like ceremony practised a century ago, towards the end of December, at La Civtat, near Marseilles, but there the Wren's murderers were armed with swords and pistols, and their victim was slung to a pole borne, as if it were a heavy load, on the shoulders of two men, who paraded the village, and then, after gravely weighing it in a pair of great scales, all gave themselves up to festivity. It is for antiquaries to throw light on the origin of this widely-spread custom, of which many unsatisfactory explanations have been attempted. It has been ascribed to a Wren which, alighting on a drumhead, roused and saved from defeat some Protestant troops in the Irish civil wars of the seventeenth century. Others refer it to a similar incident some centuries earlier, in the wars of the Danish occupation of Ireland. Others say that the Wren was an object of so great veneration to the 'Druids,' that the early Christian missionaries enjoined its persecution upon

* Edition of Yarrell's "British Birds," p. 460.

all adherents to the new faith. Any speculations would here be futile, though one cannot but be struck with some coincidences. The Wren, in the first line of the Irish song, is called the 'king of birds.' The Pembrokeshire ceremony was or is performed on Twelfth Day—the feast of the three kings—and the bird was also spoken of as the king. The common name of the bird, shared to some extent with the Golden-crested Wren, in most European languages—*Basiliskos*, *Regulus*, *Reyezuelo*, *Reations*, *Roitelet*, *Zaunkönig*, *Kunigsfogel*, *Ellekonge*, *Winterkoninkje*, and so forth—all assign to it the kingly dignity. These names probably are connected with the old and well-known fable of birds choosing for their king that one of them which should mount highest in the air. This the Eagle seemed to do, and all were ready to do him homage, when a loud burst of song was heard, and perched upon the Eagle's head was the exultant Wren, which, unseen and unfelt, had been borne aloft by the giant. In England this story does not seem to have had hold, and so far from ascribing royal qualities to our little favourite, it is nearly everywhere known to us by the humbler name of 'Kitty' or 'Jenny' Wren."

Considering the size of the Wren, its song is remarkably loud, sweet, and sustained, and it is also favourably regarded by every birds'-nester for its beautiful nest. The latter is placed in various situations, being sometimes built into the thatch of a summer-house, or carefully inserted in some trellis-work overhung by mosses, portions of which are grouped round the opening of the nest, in order the more effectually to conceal it from view. It is also frequently built against the side of a tree, especially if the ivy has been cut through and killed, when the bird will place its nest amidst a mass of brown and decaying leaves, some of which are also employed to conceal the position of its home. The following is a description* of a Wren's nest, as given by Macgillivray:—"One brought me by my son, and which he found while gathering plants in a wood near Melville Castle, is of astonishing size compared with that of its architect, its greatest diameter being seven inches, and its height five. It presents the appearance of a rude mass of decayed vegetables, of an irregularly rounded form. Having been placed on a flat surface under a bank, its base is of a corresponding form, and is composed of layers of decayed ferns and other plants, mixed with twigs of herbaceous and woody vegetables. Similar materials have been employed in raising the outer wall of the nest itself, of which the interior is spherical and three inches in diameter. The wall is composed of mosses of several species, quite fresh and green, and it is arched over with fern leaves and straws. The mosses are curiously interwoven with fibrous roots and hair of various animals, and the inner surface is even and compact, like coarse felt. To the height of two inches there is a copious lining of large soft feathers, chiefly of the Wood Pigeon, but also of the Pheasant and Domestic Duck, with a few of the Blackbird. The aperture, which is in front and in the form of a low arch, two inches in breadth at the base, and an inch and a half in height, has its lower edge formed of slender twigs, strong herbaceous stalks, and stems of grasses, the rest being felted in the usual manner. This nest is a magazine of botany, there entering into its composition leaves of *Fagus sylvatica*, fronds of *Aspidium dilatatum* and *A. filix-mas*, blades of *Phalaris arundinacea*, stems of several grasses and other herbaceous plants, some twigs of the larch and other trees, and four or five species of *Hypnum*. It contained five eggs, of an elongated oval form, averaging eight lines in length and six lines in breadth, pure white, with some scattered dots of light red at the larger end, one of them with scarcely any, and another with a great number. Of three nests presented to me by Mr. Weir, one is extremely beautiful, being composed entirely of fresh green hypna, without any internal layer, although, no eggs having been found in it, it possibly had not been completed. It is of an oblong form, seven inches in length, and four in its transverse diameter. The mouth measures an inch and eight-twelfths across, one inch and a twelfth in height. Its lower part is formed of small twigs of larch laid across and interwoven, so as to present a firm pediment. The longitudinal diameter of the interior is three inches and a half. Another, formed on a decayed tuft of *Aira caspitosa*, is globular, six inches in diameter, and composed of moss, with a lining of hair and feathers, chiefly of the domestic fowl. The third is globular, and externally formed almost entirely of ferns like that described above. In all the nests of this species which I have seen the lower part of the mouth was composed of twigs of trees or stems of herbaceous plants, laid across, and kept together with moss and hair. The nests are found in a great variety of situations: very often in a recess overhung by a bank, sometimes in a crevice among stones, in the

* "British Birds," Vol. III., p. 21.

hole of a wall or of a tree, among the thatch of a cottage or outhouse, on the loft of a shed or barn, the branch of a tree, whether growing along a wall or standing free, among ivy, honeysuckle, clematis, or other climbing plants. When the nest is on the ground its base is generally formed of leaves, twigs, and straws, and its interior is often similar; but when otherwise, the outer surface is generally smooth, and chiefly composed of moss. Several authors have spoken of the nests frequently constructed by this bird in spring and afterwards abandoned, and have indulged in various conjectures respecting them. I should suppose that a nest may occasionally be partially or entirely built, and then deserted, because its owners find it unsafe or have been frightened from it. The Magpie often commences a nest and leaves it unfinished, probably for the same reason; and the same remark may be made as to the Blackbird and Thrush. But Mr. Wood relates a very curious fact respecting the Wren, which is that it 'often builds itself a dwelling in autumn, and lodges in it on cold nights. These nests,' he continues, 'are mostly constructed in the usual localities, though I once found one situated in an old



THE COMMON WREN.

Garden Thrush's nest in a Portugal laurel. Frequently, also, the nests in which one or two broods had been reared in summer are tenanted every night throughout the winter.' On this subject Mr. Weir has sent me the following remarks:—'During the period of incubation, the male (says an anonymous writer in *Mr. London's Magazine*), apparently from a desire to be doing something, constructs as many as half-a-dozen nests in the vicinity of the first, none of which are lined with feathers; and whilst the first nest is so artfully concealed as to be seldom found, the latter are very frequently seen. With respect to the use of these structures, or cock-nests, as they are called in England, if we believe that birds, like some insects, have foresight, a more ingenious theory might be advanced. During the severity of winter they may be intended as houses of refuge for them and their families.* Whether this be always the case or not it will be difficult to ascertain. That they are, however, sometimes employed for this purpose I can affirm, as the whole of those in my neighbourhood during the late severe frosty weather (of 1837-8) were occupied by them. I have one of these nests in my possession in which they lodged, and in which there was a quantity of their droppings.' The Wren being a very diminutive bird, might be supposed to require this kind of shelter

* The writer was assured by a lad living at Colgate, Sussex, that during the severe winter of 1878-9 he frequently found Wrens roosting in the old nests, and on one occasion he captured five in the same nest.

in winter, were it not that the Kinglets and Tits, equally small, are not known to lodge in their nests. Our little friend is a Troglodyte, a frequenter of holes and caverns, and as it always reposes at night in some sheltered retreat, it may occasionally or often betake itself to its old nest as well as to any other place, as that nest is well fitted for its purpose; but there seems no reason for supposing that this is habitual with all Wrens, many of which, in the wilder parts of the country and in the Hebrides, desert their summer habitations, and in winter reside about the farmyards."

The length of the Common Wren is only three inches and a half, the wing two inches. The colour of the upper parts is rufous-brown, more decidedly rufous on the tail and wings, the upper surface barred across with blackish-brown, the outside wing feathers being barred with dark brown and dull white; over the eye a white line; below the body is dull whitish, slightly washed with rufous on the breast; the abdomen, vent, and under tail-coverts washed with rufous-brown, barred with blackish; bill brown, as well as the eye; legs light brown.

THE SECOND SUB-FAMILY OF THE TIMELIIDÆ.—THE BULBULS (*Brachypodina*).

These are a small group of birds which are intermediate between true Babblers and the Thrushes. They are remarkable for their very short legs, which are accompanied by short and very rounded wings. They are entirely inhabitants of the Old World, some genera, such as the Bristle-necked Bulbuls (*Criniger*), being widely distributed in Western Africa, and recurring again in India and the Indo-Malayan countries and islands. The Red-whiskered Bulbul (*Otocompsa jocosa*), an inhabitant of India and the Burmese countries, is said by Dr. Jerdon to be a most lively and active bird, always on the move, warbling its pleasant chirruping notes, which are more agreeable than those of the Common Bengal Bulbul. Its flight is steady but not very rapid, and its crest is always raised the moment it alights. The nest is neatly made, deep, cup-shaped, of moss, lichens, and small roots, lined with hair and down; the eggs are reddish-white with spots of lake, or purplish all over, larger at the thick end. It lives chiefly on fruits and seeds, robbing the gardens of peas, strawberries, &c. Now and then it takes insects, and Dr. Jerdon has seen it come to the ground after them. Writing of the Common Madras Bulbul (*Pycnonotus hæmorrhous*), Dr. Jerdon observes that it "frequents gardens and cultivated ground, and low bushy jungle, but is never found in forests, and it ascends the Neilgherries to about 6,000 feet only. It is usually seen in pairs, or in small families, flying briskly about, restless and inquisitive, feeding chiefly on fruits, but occasionally descending to the ground, and even hopping a step or two and picking up insects. It destroys various buds and blossoms also, and is very destructive to peas, strawberries, brazil cherries (*Physalis peruviana*), and other soft fruit. Its note, which it is frequently uttering, is an unmusical, rather harsh chirrup. It has at times, however, a sweeter note, and it is said to be able to imitate the notes of other birds when caged. Its flight is direct, performed by a continued quick flapping of the wings. It breeds from June to September, according to the locality. The nest is rather neat, cup-shaped, made of roots and grass, lined with hair, fibres, and spiders' webs, placed at no great height in a shrub or hedge. The eggs are pale-pinkish, with spots of darker lake-red, most crowded at the thick end. Burger describes them as rich madder colour, spotted and blotched with grey and madder-brown; Layard, as pale cream, with darker markings. The Bulbul is very commonly caged in various parts of the country, and in the Carnatic it is kept for fighting, being held on the finger with a cord attached. They fight sometimes with great spirit, often, I am assured, seizing their antagonist by the red feathers, and endeavouring to pull them out. When excited they often spread out these feathers laterally, so as to be seen even from above."

The account of the habits of the Bulbuls is so meagre that scarcely anything can be said about them. Perhaps the best notice that has ever appeared is that given by Captain Legge in his work on the "Birds of Ceylon":—

"The Madras Bulbul is a very common bird, and is found in Ceylon abundantly throughout the whole of the island to a general altitude of about 3,500 feet, and in Uva ranges to about 5,900 feet, its highest point being the neighbourhood of Hakgala, to which it extends from the Fort MacDonaldd patnas, a portion of the Kandyan Province where many low-country birds are located. It is most numerous in open and cultivated districts, particularly in the west and south of the island, and in the maritime portions of the eastern and northern divisions. In the extensive forests of the east and

north-central portions it inhabits chiefly those localities which have been cleared and are now open or covered with low jungle ; but in the depths of the woods it is less frequent than the White-eyebrowed Bulbul. In Dumbura and other wide valleys of the Central Province it is almost as common as in the low country, but it does not range so high on the Rambodde side as in Uva. Neither Kelaart nor Mr. Holdsworth record it from Nuwara ELLIYA, nor have I myself observed it there. That it should not occur even as a straggler or occasional visitant in the gardens of the residents, while it is not unfrequent just lower down the valley at Hakgala, is perhaps a proof that it is not able to withstand the frost and cold at nights on the plain.

"Of this Bulbul Jerdon says that it is one of the most common and generally-spread birds in the south of India, extending throughout the southern part of the peninsula to the Nerbudda river, and beyond it apparently to the north-west. It ascends the Neilgherries to about 6,000 feet, and it is, says Dr. Fairbank, found at the top of the Palanis, though it is more abundant at the bottom and on the adjacent plains ; in the Khandala district it is an inhabitant of the slopes of the hills, as well as the neighbouring portion of the Deccan. To the north-west it extends as far as Sindh, to the avifauna of which province Mr. Blanford has recently added it, stating that it is found in the deserts of Umarkot. Captain Butler remarks that it is found all over the hills and plains of Northern Guzerat, to which Mr. Hume adds, 'Common at Sambhur and in the eastern portions of Jodhpoor; also in Cutch and Kattiawar. In Western Jodhpoor it occurs for the most part only in the rains.' In Bengal it is replaced by the large and allied species *P. pygæus*, which extends eastwards into Burmah.

"The Madras Bulbul affects gardens, compounds, cinnamon plantations, the vicinity of roads, low jungle, open scrubby land, and the edges of forest. It is a fearless and very sprightly bird, most active and animated in its manners, erecting its conspicuous crest to full height as it sits on the top of a bush chirping to its companions. It locates itself in close proximity to houses, and not unfrequently builds its nest in verandahs, and is consequently a universal favourite with Europeans, who rate its attempts at singing so highly that it is styled by many the 'Ceylon Nightingale!' As a matter of fact, however, its notes have but little music in them ; but it is constantly uttering its quick chirruping warble, which, in the breeding-season, is to a certain extent more melodious than at other times. Its food consists of insects, as well as fruit and seeds of all kinds, the berry of the *Lantana* plant being a favourite diet, a fact which conduces to the propagation and spreading of this horticultural pest. In the evening little parties of this Bulbul assemble, and after a great deal of excitement and chattering they choose a roosting-place in some thick bush or umbrageous shrub.

"Jerdon remarks, in his 'Birds of India,' that in the Carnatic it is kept for fighting, and that it seizes its antagonist by the red feathers, attempting to pull them out. It is said to imitate the notes of other birds when caged. I am not aware that this habit has been much noticed in Ceylon ; but it is a great favourite as a caged bird with the natives, becoming excessively tame, and allowing itself to be carried about by hand.

"In the western and southern portions of the island this bird breeds, as a rule, between January and May, and on the eastern side during the north-east rains at the end of the year. It appears, however, to have more than one brood in the year, the second being reared as late as August or September. Its nest is a loosely-made cup-shaped structure of fine twigs, grass, and bents, with a scanty lining of grass or vegetable fibre, fixed in the fork of a branch in low bushes a few feet from the ground. It frequently chooses a small lime-tree close to a dwelling, and will sometimes, as above-mentioned, build in the verandahs of houses. In a rest-house on the Trincomalie and Batticaloa road, I once found a nest placed between the tiles and a rafter over the entrance to the apartment, the pretty little owner taking no notice whatever of the passers-by, and, as we stood admiring her, scanned us from her little habitation with an amount of fearless curiosity that was charming to behold. The eggs are three or four in number, and vary somewhat in shape, the usual form being a pointed oval. The ground is reddish-white, blotched and speckled all over, but most thickly at the large end, where there is often a cap or zone of colour, with reddish-brown of two shades over a few bluish-grey spots, some eggs having much more of the latter tint than others. They measure from 0·84 to 0·87 inch in length by 0·64 to 0·66 in breadth.

"In India the breeding-season lasts in the plains from April until August, but in the Neilgherries

it breeds as early as April. Its nest is much the same as in Ceylon; but the late Mr. A. Anderson speaks of one which was 'entirely composed of green twigs of the Neern-tree on which it was built, and the under surface was felted with fresh blossoms belonging to the same tree.' Mr. Hume gives the average of sixty eggs as 0.89 inch in length by 0.65 inch in breadth."

THE THIRD SUB-FAMILY OF THE TIMELIIDÆ.—THE TRUE BABBLERS (*Timeliinæ*).

In this group of birds the short rounded wing, remarkable for its concavity, which makes this organ fit close to the body, and so becoming admirably adapted to the bush-creeping habits of the bird, reaches its fullest development in the family of Babbling Thrushes. The largest number of Babblers is met with in the Malayan Peninsula and the neighbouring islands, whence they extend in gradually decreasing numbers towards the Moluccas and New Guinea in the south, and northwards throughout the Burmese countries to Southern China and Formosa, and eastwards through the Indian Peninsula to Ceylon. The distribution of these birds is indeed interesting in the highest degree, for there can be little doubt that the genus *Tatare*, which occurs in the islands of the Pacific Ocean, is properly a member of this sub-family, and it is not until the genus *Bernieria* is met with in Madagascar that any closely-allied generic form is known. Again, the genera *Drymocapthus* and *Trichostoma*, which are considered to be two of the most characteristic forms of the Malayan Peninsula and islands, re-appear once more in the forests of West Africa, evincing another proof of the affinity which exists between the forest belt which clothes the shores of this part of Africa and the Indo-Malayan region.

The habits of the *Timeliinæ* are for the most part similar, the birds inhabiting the bush and thick underwood, feeding on insects, and living in small flocks, which are constantly on the move, and uttering during their flight a continued chattering or piping note.

THE BUSH BABBLERS.

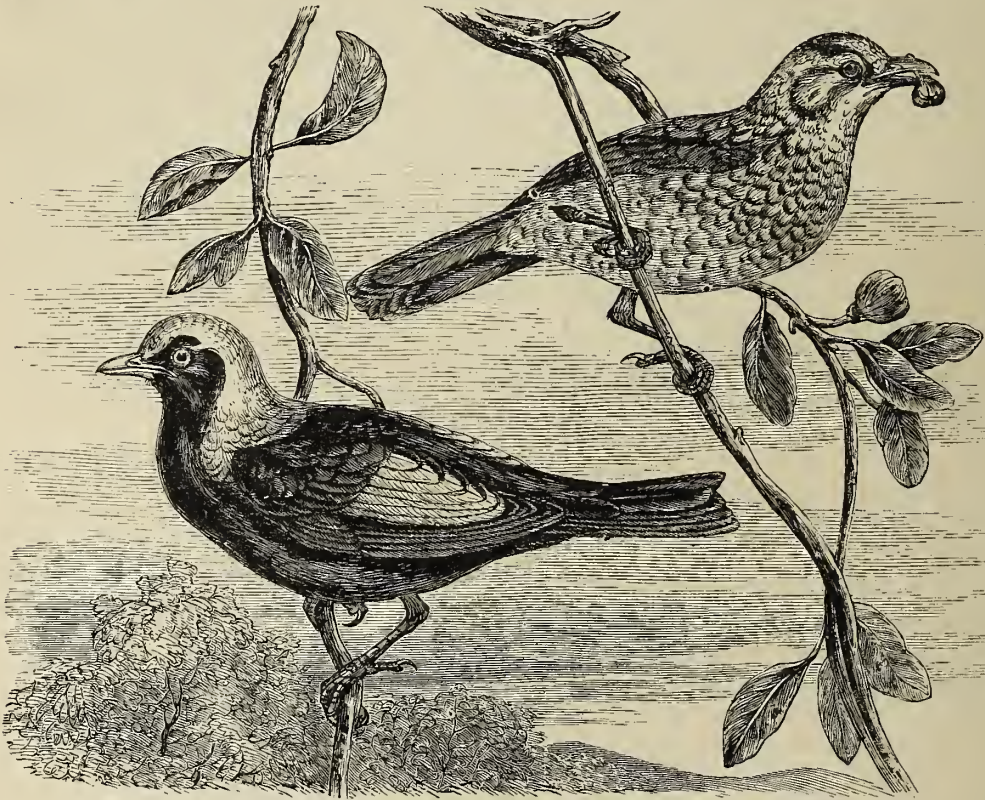
These are inhabitants of the Old World, and form a very conspicuous group of Thrush-like birds, widely distributed over Africa, and extending over India and the Burmese countries into China. Some of them are of moderately large size, exceeding the dimensions of our Common Thrush, and they are very similar in habits, living in the bushes, and hopping vigorously from bough to bough, a mode of life for which they are well fitted by their strong stout legs.

The habits of the Palestine Bush Babbler are thus described by Canon Tristram:—"It is strictly confined to the larger oases round the Dead Sea, and is well known to European residents as the 'Hopping Thrush' of Jericho, and is evidently the 'Mocking-bird' of Lynch's 'Narrative.' It is abundant in the rich oases of Ain Sultan and Ain Duk, at the north-west of the Dead Sea, in the sultry corner at the north-east, under the hills of Moab (the ancient plain of Shittim), and at the south-east end, in the luxuriant tangles of the Safich. A few inhabit the shrubs of Engedi, and we found it once or twice at the Wady Zuweirah, at the south-west of the Dead Sea. Nowhere else did it come under our observation, and thus we find a distinct and most characteristic species limited to an area of forty miles by twelve, and not occupying more than ten square miles in the whole of that area, so far as our present knowledge extends. They are most sociable and noisy birds, always in small bands, though not in large flocks, hopping along the ground in a long line, with jerking tail, and then, one after another, running up a bush, where they maintain a noisy conversation till the stranger's approach, when they drop down in single file and run along the ground, to repeat the same proceedings in the next tree. The nest is a large, clumsy structure, placed always in the centre of a thorn-tree, and requiring some little labour with the hatchet to clear a way to it. It is composed entirely of strips of bark loosely woven together, and without any other lining. One in my collection looks much like a very large nest of Savi's Warbler, from this peculiarity of the employment of but a single material. The eggs are four to six in number, dark rich green, smaller than those of the Common Thrush, and a little larger than the eggs of *Crateropus fulvus*. The parent birds continue their attention to the young for some time after they leave the nest; and I have been amused in watching the manner in which the old bird will remain at the top of a bush, scolding and screaming at the intruder till all her brood have dropped down one after another, and are running

to the next tree, when she suddenly runs down and follows them in silence, to repeat the same manœuvre so long as she is followed. Their food consists principally, if not entirely, of the berries of the zizyphus, or jujube, which are to be found at all seasons of the year."

THE BOWER BIRDS.

Considerable difficulty has been experienced in placing these birds in the natural system; the curious habit possessed by the larger number of this sub-family, of building a bower instead of making a nest, marks them as one of the most singular of all the forms of bird life in existence. The richly-coloured Regent Bird, both from its black and yellow plumage, and from the velvety nature of the



THE REGENT BIRD. (After Gould.)

feathers on the head, shows a certain approach towards the Birds of Paradise, while on the other hand, the Cat birds and true Bower birds are somewhat Thrush-like in appearance. They appear to the writer to be well placed among the Thrush-like birds, albeit very aberrant ones.

THE REGENT BIRD (*Sericulus melinus*).

Concerning the habits of this species, Mr. Gould * writes:—"This beautiful species, one of the finest birds of the Australian Fauna, is, I believe, exclusively confined to the eastern portion of the country. It is occasionally seen in the neighbourhood of Sydney, which appears to be the extent of its range to the southward and westward. I met with it in the bushes at Maitland in company, and feeding in the same trees with the Satin and Cat birds and the *Mimeta viridis*. It is still more abundant on the Manning at Port Macquarrie, and at Moreton Bay. I sought for and made every inquiry respecting it at Illawarra, but did not meet with it, and was informed that it is never seen there, yet the district is precisely similar in character to those in which it is abundant, about two degrees to the eastward. While encamped on Mosquito Island,

* "Handbook to the Birds of Australia."

near the mouth of the River Hunter, I shot several, and observed it to be numerous on the neighbouring islands, particularly Baker's Island, where there is a fine garden, and where it commits serious injury to the fruit crops. Although I have spoken of this bird as abundant in the various localities referred to, I must mention that at least fifty out of colour may be observed to one fully plumaged male, which, when adorned in its gorgeous livery of golden-yellow and deep velvety-black, exhibits an extreme shyness of disposition, as if conscious that its beauty, rendering it a conspicuous object, might lead to its destruction. It is usually therefore very quiet in its actions, and mostly resorts to the topmost branches of the trees; but when two gay-coloured males meet, conflicts frequently take place. To obtain specimens in their full dress considerable caution is necessary; on the



THE SATIN BOWER BIRD.

other hand, females and immature males are very tame, and, when feeding among the foliage, appear to be so intent upon their occupation as not to heed the approach of an intruder; and I have occasionally stood beneath a low tree, not more than fifteen feet high, with at least ten feeding voraciously above me. I did not succeed in discovering the nest; but the late F. Strange, writing from Moreton Bay, informed me that it is rudely constructed of sticks, no other material being employed, not even a few roots as a lining. On the 4th of November I observed one building, and as I was leaving for Richmond the next day, I gave instructions that it should be taken fifteen days after; when the time arrived, however, no native could be got to secure it, and it remained till my return on the 4th of December. I then sent a native up, and he brought me the nest, with two young ones covered with down, except the wings, which were feathered. As the two birds quite filled the nest, and I have heard of other nests being taken with the same number of birds in them, I am inclined to believe that two is the normal number of eggs laid. After taking the young, I wounded and succeeded in capturing the old bird, which, after being two days in confinement, became reconciled to captivity, attended to

her progeny, fed them, and removed the dirt that accumulated in the nest. The eggs are still a desideratum, and their acquisition would be a source of much gratification to me. The following extract from a paper on the habits of this fine bird, by C. Coxen, Esq., of Brisbane, read at a meeting of the Queensland Philosophical Society on the 23rd of May, 1864, I consider to be of high interest, as affording a clue to the position the bird should occupy in our system :—‘ Although the Regent-bird has been known to ornithologists for many years, very little of its habits has become known, and it has been left for me to bring under notice the very peculiar and curious habit it enjoys in common with the Satin-bird (*Ptilonorhynchus* holosericeus*) and the spotted Bower-bird (*Chlamydodera† maculata*). My attention was called to this peculiarity in August last, by Mr. Waller, taxidermist, of Edward Street, in this city, to whose untiring energy and ability as a collector I must always bear testimony. Mr. Waller informed me that while shooting in a scrub on the banks of the Brisbane River, he saw a male Regent-bird playing on the ground, jumping up and down, puffing out its feathers, and rolling about in a very odd manner, which occasioned much surprise, never having seen the bird on the ground before. The spot where it was playing was thickly covered with small shrubs. Not wishing to lose the opportunity of procuring a specimen, he fired, but only succeeded in wounding it; and on searching the spot he found a bower formed between, and supported by two small brush plants, and surrounded by small shrubs—so much so, that he had to creep on his hands and knees to get to it. While doing so, the female bird came down from a lofty tree, uttered her peculiar note, and lit on a branch immediately over the bower, apparently with the intention of alighting in front of it, but was scared away on seeing Mr. Waller so close to her. She continued flitting over the place, and calling for her mate so long as he was in the neighbourhood. Mr. Waller believes that the male bird, after being wounded, fluttered to some distance from the bower, and died, as a male Regent-bird was found dead two days afterwards in a more open part of the brush. On visiting the scrub on the following and several successive days, the female bird was seen in the locality of the bower, and by her constant calling was apparently lamenting the loss—or what might seem to her the inconstancy—of her mate. The ground around the bower was clear of leaves for some twelve or eighteen inches, and had the appearance of having been swept, the only objects in its immediate vicinity being a small specimen of *Helix*. The structure was alike at both ends, but the part designated as the front was more easy of approach, and had the principal decorations; the approach to the back being more closed by scrub. Mr. Waller being desirous that this curious habit of the Regent-bird should be verified, determined to leave the bower untouched until he had acquainted me with his discovery. Circumstances occurred to prevent me from accompanying him to its whereabouts until the following November, when we found the bower in good preservation. Previous to my seeing and examining the structure, I must confess to having had considerable doubts as to whether it would not prove to be a bower of the Satin-bird, but these doubts were dissipated at the first glance, the formation of the structure differing considerably, and the decoration more so. With Mr. Waller’s assistance I removed the building without injuring or in any way defacing its architectural style. It may not be inopportune for me to state that I was the first to discover the bower and habits of the Satin-bird, and, also among the first discoverers of the bower of the spotted Bower-bird, that I have had frequent opportunities of seeing them in the New South Wales brushes and the myall scrubs to the westward, and am consequently conversant with their peculiarities. The bower of the Regent-bird differs from the Satin-bird’s in being less dome-shaped, straighter in the sides, platform much less, being only ten inches by ten, but thicker in proportion to its area, twigs smaller and not so arched, and the inside of the bower smaller; indeed, I believe, too small to admit an adult Satin-bird without injury to its architecture. The decorations of the bower are uniform, consisting only of a small species of *Helix*, herein forming a marked contrast from the Satin-bird. Mr. Gould has shown his usual power of observation and knowledge of generic distinctions in having placed the Regent-bird next in order to the Satin Bower-bird, without having any knowledge of its peculiar building instincts. The Regent-bird frequents our river scrubs during the winter months, from the beginning of May to the end of September, coming from the south, whither he repairs during the summer. Its food consists of berries, wild fruits, and insects. In confinement it greedily disposes of house-flies, cockroaches, and small insects, showing great activity in their capture; but its

* πτερόν, a feather; ῥύγχος, a bill.

† χλαμύς, a mantle; δέρη, a neck.

principal food is the banana, of which it eats largely. It is very bold and pugnacious, the young males particularly so. In confinement several cases have occurred of one having killed the other. The young males closely resemble the females in plumage during their first year, in the second they partially assume the gay plumage of their sire, and in their third year they put on the full livery of the adult male.’”

The male has the head and back of the neck, running in a rounded point towards the breast, rich bright gamboge-yellow, tinged with orange, particularly on the centre of the forehead; the remainder of the plumage, with the exception of the secondaries and inner webs of all but the first primary, deep velvety-black; the secondaries bright gamboge-yellow, with a narrow edging of black along the inner webs; the first primary is entirely black, the next have the tips and outer webs black; the half of the inner web and that part of the shaft not running through the black tip are yellow; as the primaries approach the secondaries, the yellow of the inner web extends across the shaft, leaving only a black edge on the outer web, which gradually narrows until the tips only of both webs remain black; bill yellow; irides pale-yellow; legs and feet black.

The female has the head and throat dull brownish-white, with a large patch of deep black on the crown; all the upper surface, wings, and tail, pale olive-brown, the feathers of the back with a triangular-shaped mark of brownish-white near the tip; the under surface is similar, but here, except on the breast, the white markings increase so much in size as to become the predominant hue; eyes brown; bill and feet black.

THE FOURTH SUB-FAMILY OF THE TIMELIIDÆ.—THE GRASS-WARBLERS (*Cisticolinæ*).

In this sub-family must be placed the large group of Grass Warblers, or Fantails, which are largely developed in the African continent, and range throughout Southern Europe and the whole of the Indian region, extending even into Australia. One of the best known species is

THE COMMON FANTAIL WARBLER (*Cisticola cursitans*).

This bird is spread over the whole of Southern Europe, over the whole of Africa, India, and China, and is remarkable for the beautiful nest which it makes, and for the great variety in the colouring of its eggs. Captain Vincent Legge writes to Mr. Hume from Ceylon:—“It breeds in the western province from May until September, and constructs its nest either in paddy-fields or in *Guinea*-grass plots attached to bungalows. The nest is so beautiful and so neatly constructed that perhaps a short description of it will not be out of place. A framework of cotton or other fibrous material is formed round two or three upright stalks, about two feet from the ground, the material being sown into the grass, and passed from one stalk to another until a complete nest is made. This takes the bird from one to two days to construct. Several blades, belonging to the stalks round which the cotton is passed, are then bent down and interlaced across to form a bottom, on which, and inside the cotton network, a neat little nest of fine strips of grass torn off from the blade is built. This is most beautifully lined with cotton or other downy substance, which appears to be plastered with the saliva of the bird, until it takes the appearance and texture of soft felt. The average dimensions of the interior, or cup, are two inches in depth by one and a quarter in breadth. The whole structure is generally completed in about five days, and the first egg laid on the fifth or sixth day from the commencement. The number of eggs varies from two to four, most nests containing three. The time of incubation is, as a rule, from nine to eleven days. I have found but little variation in the eggs of this species either as regards size or colour. They are white or pale greenish-white, spotted and blotched in a zone round the larger end with red and reddish-grey, a few spots extending towards the point; axis, 0.63 inches; diameter, 0.51 inches. From close observation I can certify that this and many other small birds do not here sit during the day-time. I scarcely ever found a *Cisticola* on the nest between sunrise and sunset.” Mr. Hume himself also observes:—“I have myself taken several, and have had a great many nests sent to me. With rare exceptions, all belonged to one type. The bird selects a patch of dense fine-stemmed grass, from eighteen inches to two feet in height, and, as a rule, standing in a moist place; in this, at the height of from six to eight inches from the ground, the nest is constructed.

The sides are formed by the blades and stems of the grass, *in situ*, closely tacked and caught together with cobwebs and very fine, silky vegetable fibre. This is done for a length of from two to nearly three inches, and, as it were, a narrow tube, from one to one-fifth in diameter, formed in the grass. To this a bottom, from four to six inches above the surface of the ground, is added, a few of the blades of the grass being bent across, tacked and woven together with cobwebs and fine vegetable fibre. The whole interior is then closely felted with silky down—in Upper India usually that of the *Mudar* (*Calotropis Hamiltoni*). The nest thus constructed forms a deep and narrow purse, about three inches in depth, an inch in diameter at top, and one-fifth at the broadest part below. The tacking together of the stems of the grass is commonly continued a good deal higher up on one side than on the other, and it is through or between the untacked stems opposite to this that the tiny entrance exists. Of course, above the nest the stems and blades of the grass meeting together completely hide it. The dimensions above given are those of the interior of the nest; its exterior dimensions cannot be given. The bird tacks together not merely the few stems absolutely necessary to form a side to the nest, but most of the stems all around, decreasing the extent of attachment as they recede from the nest cavity. It does this, too, very irregularly; on one side of the nest perhaps no stem more than an inch distant from the interior surface of the nest will be found in any way bound up in the fabric, while on the opposite perhaps stems fully three inches distant, together with all the intermediate ones, will be found more or less webbed together. Occasionally, but rarely, I have found a nest of a different type. Of these, one was built among the stems of a common prickly labiate marsh-plant, which has mauve and white flowers. There was a straggling framework of fine grass, firmly netted together with cobwebs, and a very scanty lining of down. The nest was egg-shaped, and the aperture on one side, near the top. Mr. Brooks, I believe, once obtained a similar one; but the vast majority of the others that any of us have ever got have been of the type first described, which corresponds closely with Pässler's accounts. Five is the usual complement of eggs; at any rate, I have notes of more than a dozen nests that contained this number, and in more than half the cases the eggs were partly incubated. I have no record of more than five; and though I have any number of notes of nests containing one, two, three, and four eggs, yet these latter in almost all these cases were fresh."

Respecting the species in Africa some interesting notes are given in Layard's work on the birds inhabiting the southern part of that continent. Mr. Ayres says that in Natal they are common in the open country, frequenting much shorter grass than that visited by *Drymoica curvirostris*. Their nest is very beautifully constructed amongst the fine stalks of grass, which are drawn together towards the top, a sort of purse, or bag, being made of the finest and whitest down and spiders' webs, and attached at the sides to the grass which surrounds it, the opening being on the top. On any intruder approaching the nest the birds generally mount overhead with a flitting, eccentric flight, watching with anxiety the fate of their domicile. Their flight is tolerably strong; and when they have been disturbed once or twice it is sometimes a difficult matter to get within shot of them. Major Bulger writes from Windovgelberg:—"There is a very tiny bird abundant on the flats all around us here, which we call the 'little grass bird.' It is *Cisticola cursitans*—the smallest feathered creature I have seen in the country, and something like a diminutive Lark in appearance. When started it always rises with a whirr, and flies away, emitting a snapping noise, and occasionally an alarm note; and whilst on the ground amongst the grass, where it is commonly met with, I fancy it not unfrequently makes the same snapping noise, for often, whilst I have been walking on the flats, I have heard this sound, and presently have flushed this 'little grass bird.' It has seemed to me that this *Cisticola* possesses the power of ventriloquism, for I have remarked on many occasions that although we have heard the peculiar sound produced by this bird around us in every direction, we have never succeeded in finding more than one or two at the most of these little creatures." In his work on the "Birds of Damara Land" the late Mr. Andersson writes as follows:—"This species came under my notice in Great Namaqua Land in about 24° or 25° S. lat. I have also met with it abundantly in Southern Damara Land, and have obtained it in Ondonga. Specimens from Damara Land are of a lighter tint than those from Ondonga, but I have no doubt they are identical. It is common at some large waters on the Omaruru River, but is most difficult to shoot; it can generally only be shot on the wing as it rises, and when shot it invariably falls in the reeds, where its diminutive size easily eludes the eye. It is, however, found in many other situations besides reedy localities, but chiefly among tall, coarse grasses

growing about small periodical water-courses. When disturbed, it rises almost perpendicularly, descending nearly as abruptly, and either burying itself at once in the rank vegetation, or first perching on a grass stalk, and gradually creeping out of view, and also out of reach, for it is difficult to flush it again. The food of this little bird consists of small insects." The Fantail Warbler measures four inches in length. The top of the head and interscapulars are umber-brown, variegated with yellowish-brown; back of neck, back, and shoulders, clear yellowish-brown, with umber-brown streaks;



THE TAILOR BIRD.

rump, umber-brown; chin and throat, whitish; breast, belly, and vent, sienna-yellow; tail, moderately long, and slightly graduated; two middle feathers, broccoli-brown, margined and tipped with wood-brown; the other feathers brownish-red, broadly tipped with white, with a large umber-brown blotch just before the white, seen, as in all species, most plainly on the inner side; eyes light brown.

THE TAILOR BIRD (*Orthotomus* sutorius*).

This is a well-known Asiatic bird, occurring throughout the whole of the Indian Peninsula, the Burmese countries, and China.† It is most common in well-wooded districts, frequenting gardens, hedgerows, orchards, low jungle, and even now and then the more open parts of high-tree jungles. It is usually found in pairs, at times in small flocks, incessantly hopping about the branches of trees, shrubs,

* ὀρθός, straight; τομὸς (τέμνω), cutting.

† Jerdon, "Birds of India," Vol. II., p. 166.

pea-rows, and the like, with a loud reiterated call ; and picking various insects, chiefly ants, cicadellæ, and various small larvæ, off the bark and leaves, and not unfrequently seeking them on the ground. It has the habit of raising its tail whilst feeding and hopping about, and at times, especially when calling, it raises the feathers and displays the concealed black stripe on its neck. The ordinary note of the Tailor is *to-wee-to-wee-to-wee* ; or as syllabised by Layard *pretty-pretty-pretty* ; when alarmed or angry, it has a different call. It is a familiar bird, venturing close to houses, but when aware that it is being watched it becomes wary and shy. Mr. Hume gives a very full account of the nests, from which the Tailor-bird derives its well-known name. "In India the breeding season lasts from May to August, both months included ; but in the plains more nests are to be found in July, and in the hills more, I think, in June, than during the other months. The nest has been often described and figured, and, as is well known, is a deep soft cup enclosed in leaves, which the bird sews together to form a receptacle for it. It is placed at all elevations, and I have as often found it high upon a Mango-tree as low down amongst the leaves of the edible egg plant (*Solarum esculentum*). The nests vary much in appearance, according to the number and description of leaves which the bird employs, and the manner in which it employs them ; but the nest itself is usually chiefly composed of fine cotton wool, with a few horsehairs, and, at times, a few very fine grass stems as a lining, apparently to keep the wool in its place, and enable the cavity to retain permanently its shape. I have found the nests with three leaves fastened, at equal distances from each other, into the sides of the nest, and not joined to each other at all. I have found them between two leaves, the one forming a high back, and turned up at the end to support the bottom of the nest, the other hiding the nest in front, and hanging down well below it, the tip only of the first leaf being sewn to the middle of the second. I have found them with four leaves sewn together to form a canopy and sides, from which the bottom of the nest depended bare ; and I have found them between two long leaves, whose sides, from the very tips to near the peduncles, were closely and neatly sewn together. For sewing they generally use cobwebs, but silk from cocoons, thread, wool, and vegetable fibres are also used. The eggs vary from three to four in number ; but I find that out of twenty-seven nests containing more or less incubated eggs, of which I have notes, that exactly two-thirds contained only three, and one-third four eggs. About the colour of the eggs there has been some dispute, but this is owing to the birds laying two distinct types of eggs, which will be described below. Hutton's and Jerdon's descriptions of the eggs, *white* spotted, with rufous or reddish-brown, are quite correct ; but so are those of other writers, who call them *bluish-green*, similarly marked. Tickell, who gives them as 'pale greenish-blue, with irregular patches, especially towards the larger end, resembling dried stains of blood, and irregular and *broken lines scratched* round, forming a zone near the larger end,' had of course got hold of the eggs of a *Drymoipus*. I have taken hundreds of both types, and I note that, as in the case of *Buchanga albirietus*, eggs of the two types are never found in the same nest. All the eggs in each nest always belong to one or the other type. The parent birds that lay these very different-looking eggs certainly do not differ ; that I have positively satisfied *myself*. I quote an exact description of a nest which I took at Bareilly, and which was recorded on the spot. Three of the long ovato-lanceolate leaves of the mango, whose peduncles sprang from the same point, had been neatly drawn together with gossamer threads run through the sides of the leaves, and knotted outside, so as to form a cavity like the end of a netted purse, with a wide slit on the side nearest the trunk, beginning near the bottom, and widening upwards. Inside this, the real nest, nearly three inches deep, and about two inches in diameter, was neatly constructed of wool and fine vegetable fibres, the bottom being thinly lined with horsehair. In this lay three tiny delicate bluish-white eggs, with a few pale reddish-brown blotches at the large ends, and just a very few spots and specks of the same colour elsewhere." The male Tailor-bird measures six and a half inches in length, and has the two centre tail feathers lengthened, and measuring three and a half inches, whereas in the female these long feathers are not found, and the tail measures only two inches. The general colour is olive-greenish, the wings being brown edged with green ; the crown of the head is rufous, inclining to grey on the nape ; the tail is narrow, light brown, with a green tinge, the outer feathers narrowly tipped with white ; under surface of body white, with a concealed black spot on each side of the throat formed by the bases of some of the feathers, and seen only at times ; bill horny, the lower mandible pale fleshy ; the legs flesh colour ; eyes reddish-yellow.

THE FIFTH SUB-FAMILY OF THE TIMELIIDÆ.—THE AMERICAN BABBLERS (*Mimicæ*).*
THE THRASHERS.

These are a group of American Babbling Thrushes, representing the thick-footed Babblers of the Old World (*Crateropi*), and are not unlike some of the latter in appearance. They have the bill slender, like that of a Thrush, or else long and arched; the feet are strong, and in most of them rather long; the tail is rounded and slightly graduated, and is of a moderate length. As an example of this sub-family may be taken the Brown Thrasher of North America.† This Thrush is a common species throughout a widely-extended area, from the Rocky Mountains to the Atlantic, and from the Red River country in British America to the Rio Grande; and nearly throughout the entire territory it also resides and breeds, from Texas to the fifty-fourth parallel of latitude. It reaches New England early in May, and leaves it in the latter part of September or the first week of October, its stay varying with the season and the supply of its food. It is somewhat irregularly distributed—common in some parts of this section, and rare, or even unknown, in others. It is not found near the sea-coast beyond Massachusetts. It passes the winter in the Southern States, even as far to the north as Virginia, and is in full song in the neighbourhood of Savannah as early as the 1st of March. The song of this Thrush is one of great beauty, and is much admired by all who appreciate woodland melody of the sweetest and liveliest type. It is loud, clear, emphatic, full of variety and charm. Its notes are never imitative, and cannot be mistaken by any one who is familiar with them for those of any other bird, unless it may be some one of its western congeners. It is a very steady performer, singing for hours at a time. Its notes are given in a loud tone, and its song may often be heard to quite a distance. In obtaining its food the Brown Thrush is at times almost rasorial in its habits. In the early spring it scratches among the leaves of the forest for worms, coleopterous grubs, and other forms of insect food. By some it is charged with scratching up the hills of early corn, but this is not a well-founded accusation. Berries of various kinds also form a large part of its food, and among these the small fruit of our gardens must be included. "This Thrush," says Dr. Brewer, "is a very affectionate and devoted bird, especially to its young. It is also prompt in going to the assistance of others of its species when in trouble. Whenever intruders approach their nests, especially if their young are far advanced, they manifest the deepest anxiety, sometimes even making a vigorous defence. The writer has a very distinct recollection of having encountered, together with a younger brother, an ignominious defeat when making his first attempt to inspect the nest of one of these birds. The Brown Thrush is jealous of the intrusion of other birds of its own species to a too close proximity to its nesting-place, and will assert its love of seclusion by stout battles. In Louisiana the construction of the nest is commenced quite early in March, in Pennsylvania not until May, and in the New England States in the latter part of that month. The nest is usually not more than two or three feet from the ground. It is built in a low bush, on a cluster of briars, or among vines. I have known it to be placed in the interior of a heap of brushwood loosely thrown together. I have never met with the nest built upon the ground, but in Springfield and in other dry and sandy localities this is by no means an uncommon occurrence. These nests are frequently placed in close proximity to houses, and sometimes in the very midst of villages. The nest of the Thrasher is large, and roughly but strongly built. The base is usually made of coarse twigs, sticks, and ends of branches, firmly interwoven. Within this is constructed an inner nest, composed of dried leaves, strips of bark, and strong, black fibrous roots. These are lined with finer roots, horsehair, an occasional feather, &c. The eggs are usually four, sometimes five, and rarely six in number. They vary both in the tints of the ground colour and those of their markings, and slightly in their shape. Their length varies from .99 to 1.12 inches, with a mean of 1.05; their breadth ranges from .76 to .87 of an inch, mean breadth .81. The ground colour is sometimes white, marked with fine reddish-brown dots, confluent at the larger end or forming a broad ring around the crown. In others the markings have a yellowish-brown tint. Sometimes the ground colour is a light green."

THE MOCKING-BIRDS.

These are also exclusively American, and are distributed over the whole continent, from the far north down to the most southern part of South America. They are well known for their admirable

* *μῖμος*, a mimic.

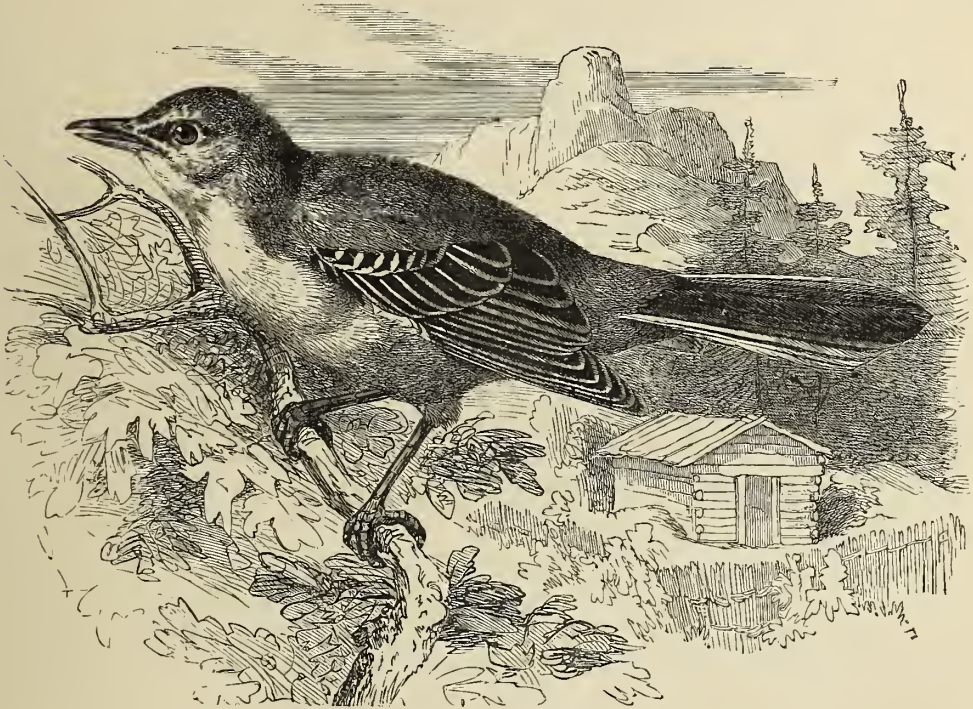
† Brewer, in "The History of North American Birds," Vol. I., p. 38.

powers of song, which place them on an equal rank with the Thrushes and Nightingale of the Old World, although their concave wings show their affinities to the Babbling Thrushes. For an account of their habits one must turn to the pages of Audubon,* from which the following remarks are copied verbatim :—

“It is where the great magnolia shoots up its majestic trunk, crowned with evergreen leaves, and decorated with a thousand beautiful flowers that perfume the air around ; where the forests and fields are adorned with blossoms of every hue ; where the golden orange ornaments the gardens and groves ; where bignonias of various kinds interlace their climbing stems around the white-flowered *stuartia*, and mounting still higher, cover the summits of the lofty trees around, accompanied with innumerable vines that here and there festoon the dense foliage of the magnificent woods, lending to the vernal breezes a slight portion of the perfume of their clustered flowers ; where a genial warmth seldom forsakes the atmosphere ; where berries and fruits of all descriptions are met with at every step : in a word, kind reader, it is where Nature seems to have paused as she passed over the earth, and, opening her stores, to have strewn with unsparing hand the diversified seeds from which have sprung all the beautiful and splendid forms which I should in vain attempt to describe, that the Mocking-bird should have fixed its abode, there only that its wondrous song should be heard. But where is that favoured land ? It is in this great continent. It is, reader, in Louisiana that these bounties of Nature are in the greatest perfection. It is there that you should listen to the love-song of the Mocking-bird, as I at this moment do. See how he flies round his mate, with motions as light as those of a butterfly ! His tail is widely expanded, he mounts in the air to a small distance, describes a circle, and, again alighting, approaches his beloved one, his eyes gleaming with delight, for she has already promised to be his and his only. His beautiful wings are gently raised, he bows to his love, and again towering upwards, opens his bill and pours forth his melody, full of exultation at the conquest which he has made. They are not the soft sounds of the flute or of the hautboy that I hear, but the sweeter notes of Nature’s own music. The mellowness of the song, the varied undulations and gradations, the extent of its compass, the great brilliancy of execution, are unrivalled. There is probably no bird in the world that possesses all the musical qualifications of this king of song, who has derived all from Nature’s self. Yes, reader, all ! No sooner has he again alighted, and the conjugal contract has been sealed, than, as if his breast was about to be rent with delight, he again pours forth his notes with more softness and richness than before. He now soars higher, glancing around with a vigilant eye, to assure himself that none has witnessed his bliss. When these love scenes, visible only to the ardent lover of Nature, are over, he dances through the air, full of animation and delight, and as if to convince his lovely mate that to enrich her hopes he has much more love in store, he that moment begins anew, and imitates all the notes which Nature has imparted to the other songsters of the grove. For a while each long day and pleasant night are thus spent ; but at a peculiar note of the female he ceases his song and attends to her wishes. A nest is to be prepared, and the choice of a place in which to lay it is to become a matter of mutual consideration. The orange, the fig, the pear tree of the gardens are inspected ; the thick briar patches are also visited. They appear all so well suited for the purpose in view, and so well does the bird know that man is not his most dangerous enemy that, instead of retiring from him, they at length fix their abode in his vicinity, perhaps in the nearest tree to his window. Dried twigs, leaves, grasses, cotton, flax, and other substances are picked up, carried to a forked branch, and there arranged. Five eggs are deposited in due time, when the male, having little more to do than to sing his mate to repose, attunes his pipe anew. Every now and then he spies an insect on the ground, the taste of which he is sure will please his beloved one. He drops upon it, takes it in his bill, beats it against the earth, and flies to the nest to feed and receive the warm thanks of his devoted female. When a fortnight has elapsed the young brood demand all their care and attention. No cat, no vile snake, no dreaded hawk, is likely to visit their habitation. Indeed, the inmates of the next house have by this time become quite attached to the lovely pair of Mocking-birds, and take pleasure in contributing to their safety. The dew-berries from the fields, and many kinds of fruit from the gardens, mixed with insects, supply the young as well as the parents with food. The brood is soon seen emerging from the nest, and in another fortnight, being now able to fly with vigour, and to provide for themselves, they leave the parent

* “Birds of North America,” Vol. II., p. 187.

birds, as many other species do. The above account does not contain all that I wish you to know of the habits of this remarkable songster, so I shall shift the scene to the woods and wilds, where we shall examine it more particularly. The Mocking-bird remains in Louisiana the whole year. I have observed with astonishment that towards the end of October, when those which had gone to the Eastern States—some as far as Boston—have returned, they are instantly known to the ‘Southrons,’ who attack them on all occasions. I have ascertained this by observing the greater shyness exhibited by the strangers for weeks after their arrival. This shyness, however, is shortly over, as well as the animosity displayed by the resident birds, and during the winter there exists a great appearance of sociality among the united tribes. In the beginning of April, sometimes a fortnight earlier, the Mocking-birds pair and construct their nests. In some



THE MOCKING BIRD.

instances they are so careless as to place the nest between the rails of a fence directly by the road. I have frequently found it in such places, or in the fields, as well as in briars, but always so easily discoverable that any person desirous of procuring one might do so in a very short time. It is coarsely constructed on the outside, being there composed of dried sticks of briar, withered leaves of trees, and grasses, mixed with wool. Internally it is finished with fibrous roots, disposed in a circular form, but carelessly arranged. The female lays from four to six eggs the first time, four or five the next, and when there is a third brood, which is sometimes the case, seldom more than three, of which I have rarely found more than two hatched. The eggs are of a short oval form, light green, blotched and spotted with amber. The young of the last brood, not being able to support themselves until late in the season, when many of the berries and insects have become scarce, are stunted in growth, a circumstance which has induced some persons to imagine the existence in the United States of two species of Common Mocking-bird, a larger and a smaller. This, however, as far as my observation goes, is not correct. The first brood is frequently brought to the bird-market in New Orleans as early as the middle of April. A little farther up the country they are out by the 15th of May. The second brood is hatched in July, and the third in the latter part of September. The nearer you approach to the

sea shores, the more plentiful do you find these birds. They are naturally fond of loose sands, and of districts scantily furnished with small trees or patches of briars and low bushes. During incubation the female pays such precise attention to the position in which she leaves her eggs when she goes to a short distance for exercise and refreshment, to pick up gravel, or roll herself in the dust, that, on her return, should she find that any of them have been displaced or touched by the hand of man, she utters a low, mournful note, at the sound of which the male immediately joins her, and they are both seen to condole together. Some people imagine that on such occasions the female abandons the nest; but this idea is incorrect. On the contrary, she redoubles her assiduity and care, and scarcely leaves the nest for a moment; nor is it until she has been repeatedly forced from the dear spot, and has been much alarmed by frequent intrusions, that she finally and reluctantly leaves it. Nay, if the eggs are on the eve of being hatched she will almost suffer a person to lay hold of her.

“Different species of snakes ascend to their nests, and generally suck the eggs or swallow the young; but on all such occasions, not only the pair to which the nest belongs, but many other Mocking-birds from the vicinity, fly to the spot, attack the reptiles, and in some cases are so fortunate as either to force them to retreat or deprive them of life. Cats that have abandoned the houses to prow about the fields in a half wild state are also dangerous enemies, as they frequently approach the nest unnoticed, and at a pounce secure the mother, or at least destroy the eggs or young, and overturn the nest. Children seldom destroy the nests of these birds, and the planters generally protect them. So much does this feeling prevail throughout Louisiana, that they will not willingly permit a Mocking-bird to be shot at any time. In winter, nearly all the Mocking-birds approach the farm-houses and plantations, living about the gardens or outhouses. They are then frequently seen on the roofs and perched on the chimney-pots; yet they always appear full of animation. Whilst searching for food on the ground their motions are light and elegant, and they frequently open their wings as butterflies do when basking in the sun, moving a step or two, and again throwing out their wings. When the weather is mild the old males are heard singing with as much spirit as during the spring or summer, while the younger birds are busily engaged in practising, preparatory to the love season. They seldom resort to the interior of the forest, either during the day or by night, but usually roost among the foliage of evergreens in the immediate vicinity of houses in Louisiana, although in the Eastern States they prefer low fir-trees.

“The flight of the Mocking-bird is performed by short jerks of the body and wings, at every one of which a strong twitching motion of the tail is perceived. This motion is still more apparent while the bird is walking, when it opens its tail like a fan and instantly closes it again. The common cry or call of this bird is a very mournful note, resembling that uttered on similar occasions by its first cousin, the *Orpheus rufus*, or, as it is commonly called, the *French Mocking-bird*. When travelling, this flight is only a little prolonged, as the bird goes from tree to tree, or at most across a field, scarcely, if ever, rising higher than the top of the forest. During this migration it generally resorts to the highest parts of the woods near water-courses, utters its usual mournful note, and roosts in these places. It travels mostly by day. Few Hawks attack the Mocking-birds, as on their approach, however sudden it may be, they are always ready not only to defend themselves vigorously and with undaunted courage, but to meet the aggressor half-way, and force him to abandon his intention. The only Hawk that occasionally surprises it is the *Astur cooperii*, which flies low with great swiftness, and carries the bird off without any apparent stoppage. Should it happen that the ruffian misses his prey, the Mocking-bird in turn becomes the assailant, and pursues the Hawk with great courage, calling, in the meantime, all the birds of its species to its assistance; and although it cannot overtake the marauder, the alarm created by their cries, which are propagated in succession among all the birds in the vicinity, like the watchwords of sentinels on duty, prevents him from succeeding in his attempts.

“The musical powers of this bird have often been taken notice of by European naturalists and persons who find pleasure in listening to the song of different birds whilst in confinement or at large. Some of these persons have described the notes of the Nightingale as occasionally fully equal to those of our bird, but to compare her essays to the finished talent of the Mocking-bird is, in my opinion, quite absurd. The Mocking-bird is easily reared by hand from the nest, from which it ought to be

removed when eight or ten days old. It becomes so very familiar and affectionate that it will often follow its owner about the house. I have known one raised from the nest kept by a gentleman at Natchez that frequently flew out of the houses, poured forth its melodies, and returned at sight of its keeper. But notwithstanding all the care and management bestowed upon the improvement of the vocal powers of this bird in confinement, I never heard one in that state produce anything at all approaching in melody to its own natural song. The male bird is easily distinguished in the nest as soon as the brood is a little fledged, it being larger than the female and showing more pure white. It does not shrink so deep in the nest as the female does at the sight of the hand which is about to lift it. Good singing birds of this species often bring a high price. They are long-lived and very agreeable companions. Their imitative powers are amazing, and they mimic with ease all their brethren of the forests or of the waters, as well as many quadrupeds. I have heard it asserted that they possess the power of imitating the human voice, but have never met with an instance of the display of this alleged faculty."

THE TENTH FAMILY OF THRUSH-LIKE PERCHING-BIRDS.—THE SHRIKES (*Laniidae*).

The Shrikes, or Butcher Birds, from their savage habits as well as from their strong hooked bills, were placed by Linnæus and the old authors in close proximity to the birds of prey. They have all very strong and powerful feet, and many of them capture living prey, such as small birds, mice, &c., but as a rule they are insect-feeders. Representatives of the Shrikes are found in every quarter of the globe, excepting South America. The first group of the Shrikes to be noticed are the Australian Thickheads (*Pachycephala*), which are distributed all over that continent, New Guinea, and the Moluccas, and throughout Oceania. Mr. Gould states that "their habits differ from those of most other insectivorous birds, particularly in their quiet mode of hopping about and traversing the branches of trees in search of insects and their larvæ. Caterpillars constitute a great portion of their food, but Coleoptera and other insects are not rejected. The more gaily attired species resort to the flowering *Acaciae*, *Eucalypti*, and other stately trees, while the more dull-coloured frequent the ground. They all build a neat, round, cup-shaped nest, and the eggs are generally four in number. Their powers of flight are not great; some enjoy a wide range of habitat, while others are extremely local. The song of some is loud and rather pleasing, while others merely emit a whistling note, slowly but frequently repeated." "The Grey-tailed Thickhead," according to the same author, "frequents the vast forests of *Eucalypti* that cover the greater part of Tasmania, and, although it is rather thinly dispersed, is to be met with in every variety of situation, the crowns of the hills and the deep and most secluded gullies being alike visited by it. It frequently descends to the ground in search of insects, but the leafy branches of the trees, particularly those of a low growth, are the situations to which it gives the preference. The adult male, like most other birds of attractive plumage, is of a shy disposition; hence there is much more difficulty in obtaining a glimpse of that sex in the woods than of the sombre-coloured and comparatively tame female, or even of the young males of the year, which during this period wear a similar kind of livery to that of the latter. The actions of this species are somewhat peculiar, and unlike those of most other insectivorous birds; it pries about the leafy branches of the trees, and leaps from twig to twig in the most agile manner possible, making all the while a most scrutinising search for insects, especially Coleoptera. When the male exposes himself, as he occasionally does, on some bare twig, the rich yellow of his plumage, offering a strong contrast to the green of the surrounding foliage, renders him a conspicuous and doubtless highly attractive object to his sombre-coloured mate, who generally accompanies him. It sometimes resorts to the gardens and shrubberies of the settlers, but much less frequently than might be supposed, when we consider that the neighbouring forests are its natural place of abode. The Grey-tailed Thickhead utters a loud whistling call of a single note, several times repeated, by which its presence is often detected. I was unsuccessful in my search for its nest, and the eggs are still desiderata to my collection."

The Great Grey Shrike (*Lanius excubitor*) is an occasional visitant to this country, but has not yet been known to breed in England. The occurrences reported of the bird's capture point to it as a winter migrant only, and at this season of the year it was observed by the writer on more than one occasion in Heligoland. It is one of the largest of the whole family of Shrikes, and is altogether a

powerful bird. The name of Butcher Bird is given to this and other species of Shrikes on account of the habit which these birds have of spitting their prey upon thorns, and often quite a collection of victims may be seen impaled upon a hedge, so as to form what is popularly called a "Shrike's Larder." The food of the present species consists of field mice, beetles, grasshoppers, frogs, lizards, and blind worms, but it will also devour small birds, and even rob nests. As an instance of its pertinacity in capturing its food may be quoted the following note by a German naturalist,* Mr. Carl Muller :—"During this winter I had the opportunity of often observing a Great Grey Shrike. He lorded it over a considerable tract, and, Shrike-like, preferred the hedges and young lime-trees skirting an avenue, where, emboldened by hunger and the severe weather, he watched for his prey, undisturbed by the passers-by. I often saw him fly a considerable distance, then suddenly rise in his flight and hover over one spot. Once when flying along he observed a mouse; he turned sharply round, and, hovering, commenced a careful examination of the ground; and his watchfulness and perseverance astonished me. Now he would hover from thirty to forty feet above the ground, now only ten to fifteen feet; then flying down to a small mound, he would sit with outstretched neck and eager glance, carefully surveying every spot near him, and after watching for a time would again take to wing. For more than ten minutes he waited and searched for the mouse, and then flew off to a thorn-bush about one hundred yards distant. But he had not given up the chase, for after a short rest he again returned to where he had first observed the animal, and repeated the search. He persevered even longer than before, and at last secured his prey by a quick surprise and several hard blows with the bill, delivered as he was hopping and fluttering over it. This Shrike once attacked a Blackbird I used to feed, which had become quite tame. He came behind it as it was feeding, threw it on its back, and, holding it fast with his claws, gave it repeated blows on the head with his beak, and, had I not hastened to the rescue, would soon have killed it. It may not be generally known that the Shrike is attracted to its prey not only by sight, but also by the sense of hearing. I have seen him hunt by ear after a young Lark, neglected by its parents, crouched in the grass calling for food, or a young Goldfinch sitting chirping on the ground; and he is well acquainted with the difference in the call-note of young and old birds. The note of the Great Grey Shrike is harsh. Naumann very correctly describes it as follows :—"Its cry is *schäch, schäch*, and the call-note *trüü*. On bright winter days, and particularly in spring, it may be heard uttering a sort of song composed of low notes mixed with its call-note; and it often also mixes with its song the notes of small birds. Both male and female sing, and they often call like the Skylark. Its nest is generally placed at some height on a tree or large thorn-bush, and is somewhat bulky and loose-looking, though the inside is carefully finished. The foundation and outside are composed of dry sticks and twigs, straws and moss; and it is lined with wool and hair." The Great Grey Shrike is about nine and a half inches in length, and is of a light blue-grey colour, with the lower region of the eye and ear-coverts black, separated from the grey of the head by a thin white eyebrow and frontal band; the cheeks and under surface of the body are white; the wings are black, with white tips to the quills, and a broad double band of white formed by the bases of the primaries and outer secondaries; the scapulars are tipped with white; tail black, with white tips increasing in extent towards the outermost feathers, which are almost entirely white. Bill black; legs slender, dark brownish-black.

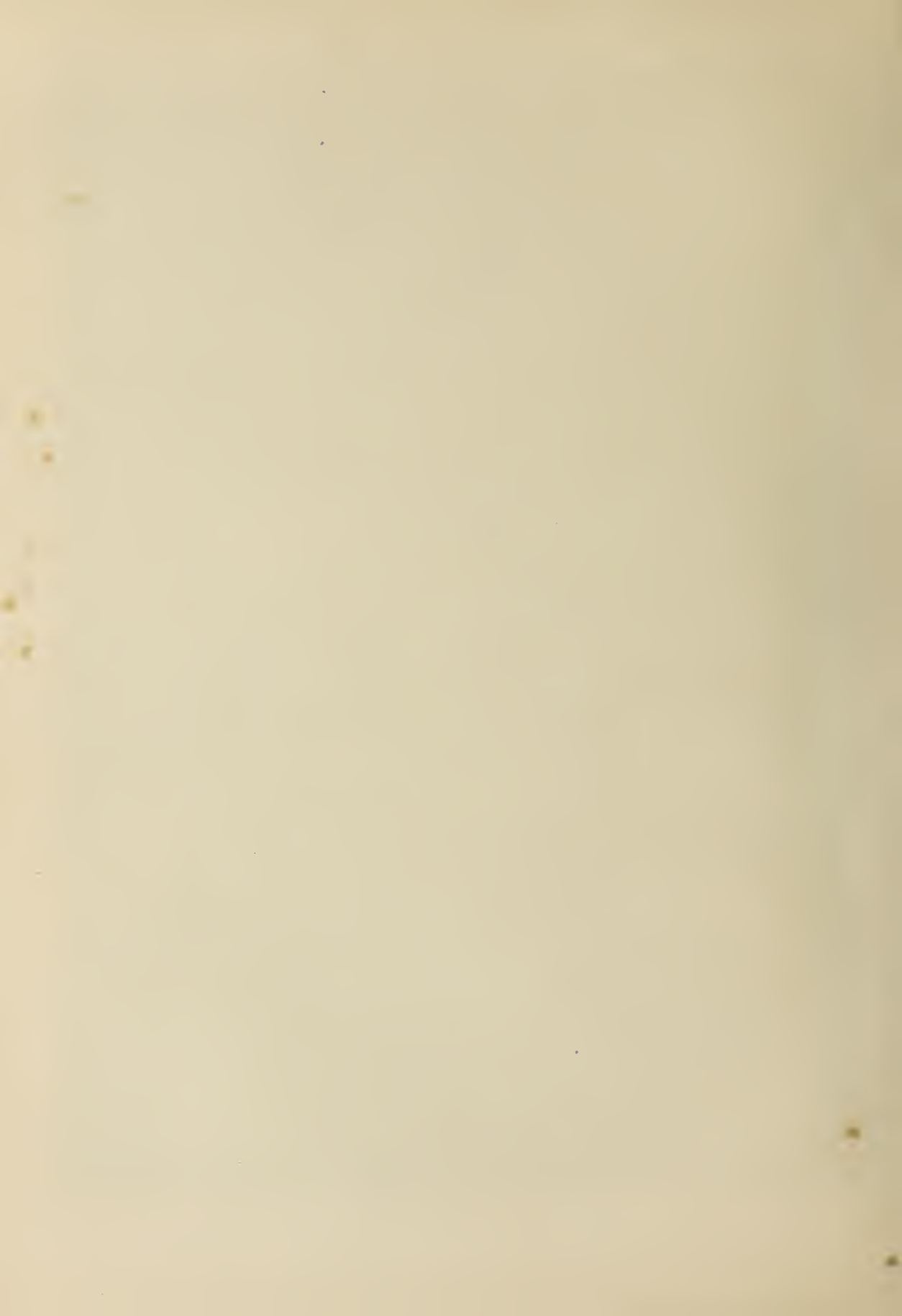
THE ELEVENTH FAMILY OF THRUSH-LIKE PERCHING BIRDS.—THE GREENLETS (*Vireonide*).

These constitute a small American family, which have apparently much in common with the Shrikes. The bill is notched in both mandibles, the tail consists of ten feathers, and the tarsi are scaled in front. The name Greenlet well illustrates the prevailing colour of their plumage. In Jamaica one of the Greenlets was described by Brown many years ago under the name of "Whip-Tom-Kelly;" and Mr. Gosse† writes of the same species (*Vireosylva calidris*) as follows :—"Much oftener heard than seen, though not unfamiliar to either sense, this sober-coloured bird is one of those whose notes have such a similarity to articulations as to procure them a common appellation. The Fly-catchers, in general, are not very vociferous, but this is pertinacious in its tritonous call, repeating it with energy every two or three seconds. It does not ordinarily sit on a prominent twig or

* "Journal für Ornithologie," 1868, p. 159.

† "Birds of Jamaica," p. 194.





dart out after insects, though I have seen one in eager but unsuccessful pursuit of a Butterfly (*Terias*) ; but it seems to love the centre of thick trees, where it sits announcing its presence, or flits from bough to bough as you approach, so that it is not easy to get a sight of it. This bird does not winter with us, but leaves, with the Grey Petebary (*Tyrannus dominicensis*), at the beginning of October. It returns early, and, like the bird just named, evidently makes an eastward progress, arriving at the south-west end of the island first. On the 26th of March, on my return to Bluefields, after a visit to Spanish Town, I heard its well-known voice, but my lad had noticed it a week before. From this time every grove—I might almost say every tree—had its bird, uttering with incessant iteration and untiring energy, from its umbrageous concealment, *Sweet-John ! John-to-whit ! Sweet-John-to-whit ! John-t'-whit—sweet-John-to-whit !* I can scarcely understand how the call can be written *Whip-Tom-Kelly*, as the accent, if I may so say, is most energetically on the last syllable. Nor have I ever heard this appellation given to it in Jamaica. After July we rarely hear *John-to-whit*, but *to-whit—to-who*, and sometimes a soft simple chirp, or *sip sip*, whispered so gently as scarcely to be audible. This, however, I have reason to believe, is the note of the young, for I have heard young ones repeatedly utter it when sitting on a twig, receiving from time to time, with gaping beak and quivering wing, the food contributed by the dam." Mr. Gosse says that the bird feeds on seeds, berries, and insects, building in June and July, and lays three eggs, white, with a few small red-brown spots thinly scattered over the surface, sometimes very minute and few.

THE TWELFTH FAMILY OF THRUSH-LIKE PERCHING BIRDS.—THE TITMICE (*Paridae*).

In this family the bill is short and conical, but without any notch at the tip of the upper mandible ; the nostrils are generally concealed by bristles ; the tarsi are very distinctly scaled, especially in the freshly-killed birds ; the primary quills are ten in number. Titmice are found all over the northern parts of the Old and New World, but disappear in South America ; nor are they represented in Australia or Oceania. Only a limited number of species are met with in Africa.

The Titmice may be divided into two sub-families: the true Titmice (*Parinæ*), and the Nuthatches (*Sittinæ*). The Titmice proper are lively and cheerful little birds, and even the murky air of London does not seem to be able to damp the spirits of such an incorrigible little chatterer as the Blue Titmouse, whose cheery note may often be heard even in the squares of our great city, while it has more than once occurred to the author to welcome him in the immediate vicinity of the British Museum, as he threads his way through the smoke-blackened trees in the adjacent gardens. It would not be fair to take one of these dusky London birds and to compare its colours with those of a country cousin, as the differences between them could be accounted for by the nature of the localities which they respectively inhabit ; but this subject recalls a very interesting problem in connection with the avi-fauna of the British Islands. It is a notorious fact that the animals and birds which are found in an island long separated from its adjacent continent are generally different in a greater or less degree from their continental relatives.

This circumstance, however, appears to have been strangely overlooked in the case of the British Islands by most ornithologists ; and the fact that our British Long-tailed Titmouse was a different species from the Long-tailed Titmouse of the Continent—an assertion which the author published in 1868—was received with incredulity by authorities who would not hesitate to admit similar instances of specific difference if the case occurred in some other portion of the globe than Europe. As a matter of fact, there is scarcely a resident species belonging to the British Islands which does not differ more or less from its Continental representative. Such remarks do not of course refer to migratory birds, which visit all parts of Europe alike, but the generality of the British birds which remain with us all the year, and do not leave the country, are always duller in colour than specimens of the same species on the Continent. Striking instances of this are seen in the Bullfinch, the Chaffinch, the Yellow-hammer, and many other birds, but the Titmice offer the strongest evidence. The Blue Titmouse, although a sufficiently pleasing bird in its coloration, cannot compare for brilliancy of tint with a specimen shot in France. The Coal Titmouse of England appears to be specifically distinct from the Coal Titmouse of the Continent, which has a blue

back, whereas the British bird (*Parus britannicus*) has the back olive-coloured. The Long-tailed Titmouse of Sweden and Germany (*Acredula caudata* of Linnæus) always has a pure white head, while in the familiar species of Great Britain (*Acredula vagans*) only the top of the head is white, bordered with a broad black stripe on each side.

THE GREAT TITMOUSE, OR OX-EYE (*Parus major*).

This is the largest species of the family found in the British Islands, and is by no means such a sociable bird as the Blue Tit, being generally seen in pairs, and seldom consorting, as does the last-named species, with Creepers, Nuthatches, and other Titmice, which form little parties in the winter and go through the woods in company. It is a very active bird, and its loud notes, which are syllabled by Macgillivray as a harsh chatter, "*Chir-r-r-r-ik*," are sure to command attention from any one walking in the woods.* "In spring and the early part of summer its notes bear some resemblance to the sounds produced by a file in sharpening the teeth of a saw, and may be syllabled into *tee-ta, tee-ta, tee-ta, tee-ta*. They are very loud for a bird of so small a size, and may be heard distinctly in calm weather at the distance of eight hundred paces. Its spring notes, Mr. Hepburn writes to me, are first heard about the beginning of March, and continued till the middle of May. In April, 1839, I pursued one of these birds through a narrow plantation. The first note I heard was that of *chur-r-r*, then *chir-r-r*; it then imitated very exactly the twink of the Chaffinch, the alarm notes of the Robin and Wren, and the doleful ditty of the Yellow Bunting; next it produced a note of its own, which it repeated incessantly as it sported amongst the boughs of an old ash; then it seemed to forget this note, and emitted another, which also was soon forgotten; and again, as if tired of its own compositions, it essayed those of its more musical brethren. This Titmouse was a great nuisance to me when I began to study ornithology, often leading me astray by its silly productions, which I thought were the notes of some bird new to me." Like all the species of the genus *Parus*, the Great Titmouse nests in the hole of a tree or of a wall, excavating in the former case the cavity itself. The eggs are sometimes deposited on rotten wood, but the nest is generally composed of grass or moss, above which is a soft bed of hair, wool, or feathers; but occasionally it becomes a very massive structure, as may be gathered from the following account given by Mr. Stevenson in his "Birds of Norfolk":—"The most extraordinary nest of this species that I ever saw or read of was discovered in a plantation at Earlham in the summer of 1859. This natural curiosity, which is carefully preserved in the collection of Mr. John Gurney, of Earlham Hall, was discovered in a rough corner cupboard, fixed at one end of an old shepherd's house erected in a plantation for the use of the gamekeeper. In the centre of the cupboard was a single shelf; and the door being kept shut, the pair of Titmice could only obtain access through a small hole in the wood-work above. Through this opening, however, the enormous amount of materials found must have been introduced bit by bit, until the centre space between the shelf and the top of the cupboard, leaving only just room enough for the hen bird to sit, was filled with a compact mass of twigs, moss, bents, feathers, rabbits' down, horsehair, wood, and even flowering grasses. Moss formed, of course, the chief substance employed; yet so wonderfully had the whole fabric been woven together that, when taken from the shelf upon which it was erected, it retained the exact shape of the three-cornered cupboard, the sides being as firm and neat as a well-kept grass edging levelled with a roller. The following dimensions of this remarkable structure will best give an idea of the skill and labour thus strangely devoted to it by its untiring architects. Length in front 15 inches, height 9 inches, depth from front to back, measured to the angle of the cupboard, 10 inches. In the centre of the upper part was a depression, in which the eggs were laid; and here, in spite of frequent intrusions from curious visitors, the hen bird being even handled on her nest, these little creatures reared five young ones and carried them off in safety. A similar nest, commenced in the previous spring, was unfortunately destroyed; but since the successful completion of the one above mentioned no further attempt has been made to repeat so formidable a task."

The Great Titmouse is about five inches and a half in length. The head, throat, and centre of the body are black, with a large white patch occupying the ear-coverts and the region below the eye; the

* Macgillivray: "British Birds," p. 428.

rest of the under surface is yellow, the under tail-coverts white with dusky centres; the back is green, the wing-coverts blue grey with a white band across, formed by the tips of the greater coverts; the quills are blackish, edged with slaty-grey, becoming white towards the tips; the secondaries are margined with yellow, shading into white towards the ends, the lower back, rump, and upper tail-coverts slaty-grey; the tail blue-grey, the outer feather edged with white; bill black, feet leaden-grey, eye black. The female is like the male, but has the black on the head and throat more dingy, and has the black stripe down the breast less distinctly marked. Young birds may always be told by a tinge of yellow on the cheeks. The range of this species appears to extend throughout the whole of Europe and Northern Asia.

The Long-tailed Titmouse (*Acredula vagans*) belongs to a small genus of birds, distinguished from the true Titmice by their long graduated tails, which consist only of ten feathers. They are found throughout the Palearctic region, Europe, and Northern Asia. They differ greatly in their mode of nesting, not building, like the *Parus*, in holes of trees or trees, but constructing a most beautiful domed nest, from which circumstance their popular English names of Bumbarel and Bottle-Tit are derived. "Wonderful, indeed," writes Mr. Gould, "is the architectural skill displayed by the Long-tailed Tit in the construction of its closely-felted nest, so warmly lined with feathers and externally bespangled with lichens. Who can behold it without feeling the highest admiration of the bird's skill and perseverance? If closely inspected, it will be found that the glaucous sides of the lichens are always placed to the light, whereby the exterior is rendered still more beautiful. In the description of the nest given below, it will be found that 2,000 feathers were taken from a single lining. With what care, then, and diligence must the bird search for so many feathers on the surface of the ground! But this is as nothing compared with the amount of invisible cobwebs collected wherewith to attach the decorative bits of lichen to the outside When these birds [the young] are about ready to fly, they are very different in colour from the adults, and are altogether very singular little creatures—their comparatively short tails, broad bills, thick, fleshy, yellow gape, red-ringed eyes, and white crowns strongly contrasting with the hues of the old birds. When these nestlings leave their cradle for the trees, they sit on the sunny side of the branches, and are there fed by their parents. They soon gain strength, and flit about for their own living; and when night comes on crowd together on a low branch in a huddled heap, resembling a ball of feathers, their united bodies giving out more heat in a mass than if perched singly. In the early morn, when the sun first sends forth his genial rays, these little Tits may often be seen sitting in a row, all facing that luminary, and at other times perched alternately head and tail so regularly as to astonish those who for the first time witness it. A nest taken in the garden of Formosa, near Cliveden, on the 2nd of May, 1861, was of large size and of an oval form, with an entrance in the side near the top. It was composed of moss and cow-hair, outwardly adorned all over with small pieces of lichen affixed by means of gossamer-like fibres and the empty cocoons of spiders' eggs, and so plentifully lined with feathers of various kinds, that on being counted they proved to be about two thousand in number; among them were observed those of the Peacock, Turkey, Partridge, Barn-door Fowl, Greenfinch, Wood Pigeon, Duck, Turtle-dove, Thrush, Blackbird, &c. It contained ten eggs, the total weight of which was 142 grains, their colour white, thinly speckled with pale red."

In his beautiful work Mr. Gould has figured a group of young Long-tailed Titmice, and has given an illustration of a mass of these little birds closely packed together on the branch of a tree. That the species does collect in large numbers, after the fashion of the African Colies and other birds, is proved by the fact, vouched for by Mr. J. H. Gurney, that Mr. Noble, of Darlington, once fired at an object on a tree which he took for a Pheasant, but which proved to be a great ball of Long-tailed Tits. Whether the ordinary Long-tailed Titmouse of France is the same as the British species has not yet been determined; but the bird of Northern Europe and Asia is the White-headed Titmouse (*Acredula caudata*), which is again replaced in Japan by another species (*Acredula trivirgata*), not unlike our own bird. In Spain and Italy the Long-tailed Titmouse (*Acredula irbii*), is distinguished by its grey back; and a specimen of this bird was shot by the author about thirty miles from Paris, who can testify to its having a different note to that of the English species.

The present species is about six inches in length, and has the back and tail black, the outermost white with a black base, the latter increasing on each feather towards the centre of the



GROUP OF EUROPEAN TITMICE, WITH NUTHATCH AND GOLDCRESTS.

tail; scapulars vinaceous red; crown of head white, with a broad black streak on each side, running from beneath the eye and joining the black on the hind neck; sides of face, throat, and breast white; the ear-coverts streaked with dusky; the rest of the under surface vinaceous; wings black; the inner greater coverts tipped with white, and the secondaries externally edged with whitish, the inner ones more broadly so; eyelid orange; bill and feet black; eye dark brown.

The female does not differ from the male, but the young birds are much more dusky in colour than the adults, and have longer tails. This curious fact is witnessed also in the case of some of the Humming-birds.

THE NUTHATCHES (*Sittina*).

These birds have longer bills than the Titmice, and their plumage is more compact, that of the last-named birds being rather fluffy. They are all inhabitants of the northern parts of the Old and the New World, being well represented in North America. True Nuthatches also occur in the Himalayas and in the hills of Burmah; in India and the Malayan Islands, the Blue Nuthatches (*Dendrophila*), an outlying representative of which is seen in the Coral-billed Nuthatch (*Hypherpes corallirostris*) of Madagascar; in Australia and New Guinea the Nuthatches belong to a closely-allied



THE COMMON NUTHATCH.

but distinct genus (*Sitella*). Like the Titmice, these birds build generally in the hole of a tree; but a striking exception to the general rule is exhibited in the British Museum, where there is a nest of the Nuthatch, presented by Mr. Bond, composed entirely of mud, and built into the side of a haystack. Mr. Bond writes:—"I have received this summer from the neighbourhood of East Grinstead a nest built by a pair of Nuthatches, which is so remarkable in its construction, and in the site selected for it, that I think a notice of it is worth recording. It is well known that the Nuthatch almost invariably makes use of a hole, either in a tree or wall, in which to deposit its eggs, and is not, in the strict sense of the word, a nest-builder. In this instance a haystack was selected, and the birds, by pulling out a quantity of the hay, and plastering up the hollow with mud brought from a considerable distance, formed a nest of similar construction to that of a Swallow, but very much larger, with an entrance-hole near the top, and the ends of the hay stems neatly embedded in the mud. The particulars which were sent to me with the nest are shown in the following letter of my correspondent:—

" ' East Grinstead, September 8th, 1871.

" ' SIR,—The height of the nest from the ground was between five and six feet. The lining was composed of decayed leaves only (enclosed are a few which fell from the nest during the packing).

The birds were observed pulling the hay from the stack, till they had formed a large opening, before they commenced building with mud, which they had to carry about one hundred and fifty yards, that being the nearest point where they could obtain it. My informants (two men working on the farm) say that they saw the birds were building for a very long time, quite six weeks or two months, and they could not understand what the birds were plastering a lot of mud on the stack for.

“ ‘W. MAY.’ ”

“ To this I may add that the nest cut out of the stack weighed as nearly as possible eleven pounds, and measured thirteen inches in length, by eight inches in its greatest breadth, and four inches in thickness. The lining, which my correspondent mistook for dead leaves, was in reality composed of the scaly inner bark of the fir. There were five eggs, one of which was unfortunately broken.

“ When we consider the comparatively small piece of mud which can be carried in the bill of a Nuthatch, and the great distance from which it had to be brought in this case, the size and weight of the nest are extraordinary.”

In their habits the Nuthatches bear considerable resemblance to the Creepers, although they do not possess the spiny tail of the latter. The bill, too, instead of being thin and curved, is short and wedge-shaped, and is a formidable little organ when used by the bird for the purpose of prising off the bark in order to get at the insects underneath. Often has it occurred to the writer to stand beneath a tree on which a Nuthatch is engaged at work ; the first indication of its presence being a loud musical note, *t'wit, t'wit, t'wit*, or the loud and decisive hammering with which the bird prepares to scare the insects which are immediately to become its food. The Tree Creeper flies from tree to tree, invariably commencing at the bottom and working its way towards the top ; not so the Nuthatch, which from the high branches of an adjoining elm will visit a row of trees in succession, beginning at the middle or higher branches, along which it runs with great facility, occasionally descending the trunk head downwards, which is a position never adopted by the Tree Creeper. In the winter it consorts with Titmice of various kinds, and joins them in their excursions through the woods. It is, as a rule, not particularly shy, and will often allow of a close approach when busily engaged in detaching a piece of bark, of which material the bird is able to dislodge with its wedge-shaped bill a portion so large as would scarcely be believed by any one not acquainted with the habits of the Nuthatch. The distribution of our English bird is interesting, as it is not the same as the white-breasted species of Northern Europe. It inhabits the British Islands and Central and Southern Europe, extending as far eastward as Persia, and even ranging into South-eastern Siberia. In Europe it occurs in the peninsula of Jutland, but is replaced in the other Danish islands by the white-breasted form, which spreads throughout the whole of Northern Europe and Northern Asia to Japan.

The Common Nuthatch measures about five inches and a half in length. The general colour of the upper parts is slaty-blue, including the wings and the two centre tail-feathers ; the remainder of the feathers black, grey at the tips, with a sub-terminal spot of white ; a broad black band from the base of the bill running through the eye as far as the nape ; under surface of body pale cinnamon, deeper on the flanks ; the cheeks and throat white ; the under tail-coverts chestnut with white centres ; under wing-coverts blackish ; bill brownish horn colour, with a yellow spot at the base ; legs dull brown, iris brown.

CHAPTER IV.

CREEPERS—HONEY-EATERS—PIPITS AND WAGTAILS—THE AMERICAN CREEPERS— THE AMERICAN WARBLERS.

THE CREEPERS—Small Order—Characteristics—THE COMMON CREEPER—Its Call-note—Macgillivray's Account of its Habits—Nest and Eggs—THE HONEY-EATERS—Distinctive Features—THE TRUE HONEY-EATERS—THE WARTY-FACED HONEY-EATER—Mr. Gould's Description of the Species—THE SUN-BIRDS—Distribution—Mr. Keulemans' Account of their Habits—Canon Tristram on the Jericho Sun-bird—THE SECOND SUB-ORDER OF THE PASSERIFORMES—THE FRINGILLIFORMES, OR FINCH-LIKE BIRDS—Distinctive Features—WAGTAILS AND PIPITS—Characteristics—THE PIED WAGTAIL—Essentially English Bird—Victimised by Cuckoos—Macgillivray's Account of the Wagtail's Habits—Story of a Season Ticket—THE AMERICAN CREEPERS—Difference between the Creepers of the Old and of the New World—THE BANANA QUIT—THE AMERICAN WARBLERS—Compared with their Old World Cousins—THE SUMMER YELLOW BIRD—Dr. Brewer's Account of its Habits.

THE THIRD GROUP OF THE TURDIFORMES—THE CERTHIIMORPHÆ— CREEPERS.

THIS is an order of very small dimensions, the number of species contained within its limits not exceeding fifty. They are all climbing birds, running about the trunks of trees very much after the manner of Woodpeckers: they also resemble the latter in their stiffened tails. The resemblance to a Woodpecker is of course only in the similarity of the creeping habits of the two birds, for there can be no difficulty in recognising a Creeper from its foot, which has not the zygodactyle arrangement of a Woodpecker, but has the toes placed three in front and one behind.

In the Certhiimorphæ the hind toe is very large, the other toes being very slender, long, strongly compressed at the base, and joined to one another as far as the first joint, the claws extremely sharp, strongly compressed, and the middle one not oblique. The bill is very slender and long, being curved in the True Creepers, while it is stout and wedge-shaped in the Nuthatches, so much so that in the last-named birds it becomes a powerful weapon for tapping at the trunks and branches of trees, and for prising off the bark to get at the insects underneath.

THE COMMON CREEPER (*Certhia familiaris*).

The range of this little species is very considerable, as it is found not only over the whole of Europe and Northern Asia, extending as far east as Japan, and southward to the Himalayas, but it also inhabits the whole of North America as far as Mexico. In England it is tolerably plentiful everywhere, and is often to be seen in winter traversing the woods in company with Nuthatches, and the different kinds of Titmice; in the spring and summer it is usually seen in pairs, which keep up a constant call-note, consisting of a single syllable, and generally rather ventriloquial in its nature, so that it often seems to be uttered quite close to the observer when in reality the bird is at some little distance. Once on a cold winter's morning in March, as the writer was engaged in collecting birds in a park at Mongeron, in France, he was considerably startled by hearing close to him a loud and not unmusical song, like that of a Titmouse, not a single bird of the latter family being apparently within sight. After scanning the trees in all directions in search of the songster, who still continued to pour forth his notes at short intervals, the musician was discovered to be none other than a Creeper, who was clinging to the trunk of a tree about ten yards off, and continuing his song at intervals after a short diversion in pursuit of insects. This struck the writer as curious, as he had never heard a Creeper sing in England, nor has he found any one else who has ever done so; but Professor Newton states that during the breeding-season the male utters a song which is loud and pleasing, though not often heard, and pitched in a high, shrill key. The Creeper from Southern Europe has been supposed to be a distinct species from the true *C. familiaris* of Northern Europe, but a comparison of specimens does not bear out this view, though the songless characteristic of our British bird, as compared with the loud song which is possessed by the continental Creeper, would seem to favour the idea of their being different. In the Riviera, M. Basil Brooke states that the males also sing lustily.

The following is Professor Macgillivray's account of the habits of the Creeper :*—"In winter, should you fall in with a flock of Reguli and Pari scouring a wood, you may be pretty well assured that a few Tree Creepers will be found at no great distance. There, clinging to the rough bark at the base of that old elm, you see one advancing upwards by short jerks. At each movement it emits a shrill but feeble cry. See how it climbs, searching every crevice, now proceeding directly upwards, now winding round the trunk, presently passing behind it, and in a short time appearing on the other side. Observe it well, and you will see that it crouches close to the surface, presses its tail against it, now and then picks something from a cleft, jerks itself forward, never rests for a moment, but it seems in utmost haste, and expresses its anxiety by continually emitting its lisping cry. Yet its efforts are not laborious; it seems to hold on with perfect ease and unconcern, and although it is now half-way up, it exhibits no sign of fatigue. There it passes off from the



THE COMMON CREEPER.

trunk, creeps along a nearly horizontal branch, winding round it, adhering even to its lower surface with its back toward the ground. Having gone as far as it finds convenient, it flies back to the trunk, which it ascends until you lose sight of it among the twigs at the top. What next? Will it creep down again? No. There it comes with headlong flight, glancing like an arrow curves as it comes near the ground, alights at the very root of the next tree, and commences its ascent. You may watch it for an hour, and you will find it as fresh, as lively, and as keen as ever. Should it happen to observe you, and suspect that you mean it no good, it will run up the back of the tree, appearing now and then at the sides, until it is perhaps half-way up, when it will search all parts alike, being free of the apprehension of injury. But now, hearing its friends the Tits and Reguli at a distance, it looks abroad for a moment from the top of the tree, and uttering a few cries, sweeps away in a curving, somewhat undulating course.

"Such, in fact, is the ordinary course of action of the Creeper, which is thus of very peculiar and remarkable habits. It alights at the bottom of a tree, clinging to the bark with its claws, and without a moment's delay begins to ascend, which it does by short starts, leaping forward, as it were, and supporting itself by pressing the tail against the bark. In this manner it proceeds, diligently searching for

* "History of British Birds," Vol. III., p. 36.

insects, which it picks out with the greatest dexterity. Should a person curious to observe its motions go very near, it winds round so as to keep on the further side of the tree, but seldom flies off. Should it meet with a horizontal branch, it can easily proceed along its lower surface, although in that case it usually prefers the sides or upper part. When it has searched the branch it flies off to another, or continues to ascend the stem; and when it has attained the higher branches, it flies off to the base of a neighbouring tree, and thus proceeds unceasingly. Indeed, I have seldom observed one a single moment at rest. Yet, like other birds, it has its period of cessation from labour, and in the breeding-season it is amusing to observe the gambols of a pair, which may be seen chasing each other along the trunk of a tree, perching for a moment on the branches, and then scudding along, all the while emitting their shrill and feeble cries. These birds are easily shot, for, like the Gold-crested Kinglet and Coal Tit, they seem to pay little attention to a person approaching them, insomuch that I have been within six feet of one, which yet did not fly off, but merely crept round to the other side of the tree. While thus employed it utters every now and then a very low chirp, and when flying from one tree to another, repeats this cry more frequently and somewhat more loudly. I suppose that it is destitute of song, never having heard it emit modulated sounds. Its flight is generally short and rapid, from the top of one tree to the base of another; but it may sometimes be seen traversing a space of several hundred yards, which it does with a quick and undulatory motion at a considerable elevation."

It is a permanent resident, occurs in all the wooded parts of the country, but is nowhere numerous, and never appears in flocks. In winter it shifts about from place to place, generally accompanying a flock of Tits or Kinglets, but sometimes seeking for its food solitarily, seldom entering small gardens, but often appearing in woods near houses, hedgerows, or even on large single trees. It pairs in April, and about the beginning of May begins to construct its nest, which it places in some hole in a tree, or rock, or among the roots in a mossy bank. It is composed of withered stocks and blades of grasses, moss, fibrous roots, and other materials, and is lined with feathers. The eggs, from five to seven or eight in number, are seven-and-a-half twelfths of an inch in length, five-twelfths in breadth, of a regular oval form, glossy white, sprinkled with dots and small patches of brownish-red, often disposed in a broad belt near the larger end, and leaving the narrower half unspotted. Montague states that "during the time of incubation the female is fed by the other sex, whenever she quits the nest in search of food." The young are abroad by the middle of June, and there is reason to believe that a second brood is frequently reared.

THE FOURTH GROUP OF THE TURDIFORMES—THE CINNYRIMORPHÆ— HONEY-EATERS.

The Honey-eaters are distinguished by their long extensile tongue, which in some of the species is continued backwards under the skin over the head even as far as the eye, in the way which has already been referred to in the Woodpeckers (Vol. III., p. 334 *et seqq.*). The bill is in most of the species slender, rather long and curved, and very sharp at the tip, and is more hollowed than is usual in the majority of birds. They have no rectal bristles. The greatest number of the Honey-eaters come from Australia and Oceania, and in Africa and India they are replaced by the Sun-birds. The above groups, in fact, form the only two families into which the Honey-eaters are divisible.

The first family is—

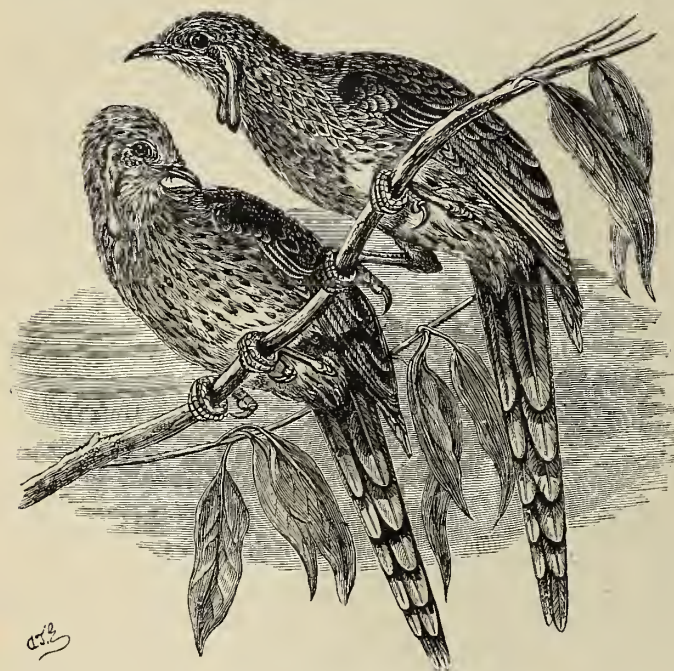
THE MELIPHAGIDÆ, OR TRUE HONEY-EATERS.

In this family the tongue is doubly cleft and pencilled at the tip; the nostrils are long, and shut in with a large horny membrane on the upper edge. The bill is shorter than in the Sun-birds. As mentioned above, the *Meliphagidæ* are entirely confined to Australia and Oceania. Speaking of them in his great work on the "Birds of Australia," Mr. Gould remarks:—"The Honey-eaters, or that group of birds forming the family *Meliphagidæ*, are unquestionably the peculiar and most striking feature in Australian ornithology. They are, in fact, to the fauna what the *Eucalypti*, *Banksiæ*, and *Melaleucæ* are to the flora of Australia. The economy of these birds is so strictly adapted to those trees that the one appears essential to the other; for what can be more plain than that the brush-like tongue is especially formed for gathering the honey from the flower-cups of the *Eucalypti*, or that their

diminutive stomachs are especially formed for this kind of food, and the peculiar insects which constitute a portion of it?"

THE WARTY-FACED HONEY-EATER (*Meliphaga phrygia*).

Mr. Gould gives the following account of this species :—"This is not only one of the handsomest of the Honey-eaters, but is also one of the most beautiful birds inhabiting Australia, the strongly-contrasted tints of the black and yellow plumage rendering it a most conspicuous and pleasing object, particularly during flight. It is a stationary species, and enjoys a range extending from South Australia to New South Wales; I also met with it in the interior nearly as far north as the latitude of Moreton Bay. Although it is very generally distributed, its presence appears to be dependent upon the state of the *Eucalypti*, upon whose blossoms it mainly depends for subsistence; it is consequently only to be found



THE WATTLED HONEY-EATER. (After Gould.)

in any particular locality during the season that these trees are in blossom. It generally resorts to the loftiest and most fully-flowered tree, where it frequently reigns supreme, buffeting and driving every other bird away from its immediate neighbourhood. It is, in fact, the most pugnacious bird I ever saw, evincing particular hostility to the smaller *Meliphagide*, and even to others of its own species that may venture to approach the trees upon which two or three have taken their station. While at Adelaide, in South Australia, I observed two pairs that had possessed themselves of one of the high trees that had been left standing in the middle of the city, which tree, during the whole period of my stay, they kept sole possession of, sallying forth and beating off every bird that came near. I met with it in great abundance among the brush of New South Wales,

and also found it breeding among the low apple-tree flats of the Upper Hunter. I have occasionally seen flocks of from fifty to a hundred in number, passing from tree to tree, as if engaged in a partial migration from one part of the country to another, or in search of a more abundant supply of food.

"The nest, which is usually constructed on the overhanging branch of an *Eucalyptus*, is round, cup-shaped, about five inches in diameter, composed of fine grass, and lined with a little wool and hair. The eggs are two in number, of a deep yellowish-buff, marked all over with indistinct spots and irregular blotches of chestnut-red and dull purplish-grey, particularly at the larger end, where they frequently form a zone: they are eleven lines long by eight lines and a half broad. The stomachs of the specimens I killed and dissected on the Hunter were entirely filled with liquid honey; insects, however, doubtless form a considerable portion of their diet."

The sexes are nearly alike in colouring, but the female is much smaller than the male, and the young are destitute of the warty excrescences on the face, that part being partially clothed with feathers. Head, neck, and upper part of the back, chin, and chest black; scapularies black, broadly margined with yellowish-white; upper tail-coverts like the scapularies; wings black, the coverts margined with yellow; spurious wing yellow; primaries black, with an oblong stripe of yellow occupying the margin of the outer and a portion of the inner web next the quill, which is black; secondaries black, broadly margined on the outer web with yellow; under surface black, with an arrow-shaped

mark of yellowish-white near the extremity of each feather; two centre tail-feathers black, slightly tipped with yellow; the remainder black at the base, and yellow for the remainder of their length, the black decreasing and the yellow increasing as the feathers recede from the two central ones; irides reddish-brown; bill black; feet blackish-brown; warty excrescences, covering the face, dirty yellowish-white.*

THE SECOND FAMILY OF THE HONEY-EATERS—THE SUN-BIRDS (*Nectariniidae*).

These birds inhabit the whole of Africa, ranging through Palestine to India, and thence through the whole of the Indian and Malayan Islands to Northern Australia, where a single species inhabits the Cape York Peninsula and Northern Queensland. The Sun-birds are divided by Captain G. E. Shelley, our first authority on this family, into two sub-families, which he calls respectively *Nectariniinae* and *Promeropinae*. In the former of these is placed the great bulk of the Sun-birds, while two species only represent the long-tailed Sun-birds (*Promerops caffer* and *P. gurneyi*). All the Sun-birds with scarcely an exception are birds of brilliant plumage, glittering with metallic lustre, so that they represent in this respect the resplendent Humming-birds of the New World; nor are they unlike the latter in their habits, hovering before the open flowers and extracting the honey and the small insects which frequent them. Of the habits of Sun-birds one may say, with the familiar maxim, *ex uno disce omnes*; for when once these have been described in the case of a single species, the remarks may be taken as characteristic of the whole family. Mr. J. G. Keulemans, who passed a considerable time in West Africa on Prince's Island (Ilha do Principe) in the Bight of Benin, writes as follows of Hartlaub's Sun-bird (*Cinnyris hartlaubi*):—"It is tolerably abundant throughout the island, with the exception of the dense woods, where it is replaced by *C. obscurus*. It is most common on the plains where bushes and bananas occur; but as Prince's Island is thickly covered with verdure, it would be difficult to say where this Sun-bird is most abundant. It is very plentiful near plantations, usually in small groups of from four to six individuals, in which the males are by far the most numerous. They have no special breeding season, for I have found young birds in every month of the year; but I find in my journal, under date of August 30th, that during that month I procured nineteen males, but not a single female; so I suppose that at that season all the hens were breeding. I collected three nests, all of which were very similar. They are of an oval form, and are suspended from one or more twigs, at an elevation of from four to twelve feet from the ground, and generally well concealed amongst the foliage. They were constructed of the hairy appendages that are found on the bark of palm-trees, rather loosely woven together and lined with the soft filaments of flowers, cotton, and other fine vegetable materials, with the opening on the side most exposed to the light. It appears to me that there is only one young bird in each brood, for I never saw the parents feed more than a single young one. It takes a long time before the latter becomes independent; for I have seen the old birds feeding their offspring after it has been perfectly able to fly, and when it was already beginning to assume its adult male plumage. The song of the male resembles that of our Hedge Sparrow, added to which are some notes similar to those of the Wren; it is, in fact, somewhat between the songs of these two birds, a little fuller and in a lower key, while the call-note is like that of the Redstart. By imitating this note they can be brought very close, and can be easily captured, as they are naturally very tame. They feed chiefly on insects, but will also eat small berries and fruit, and are very partial to sipping the juice emitted by the banana-flower before the fruit has set. I kept many alive, and fed them upon *papaya*, *banana*, and bread soaked in sugar and water, with occasionally Ant's eggs. Two males which I tried to bring to Europe died from cold, after having lived in confinement more than three months. The natives call them 'Siwie-barbeiro,' or 'Siwie boca-longe,' and the Portuguese 'Beshaflore' (flower-kissers)."†

It has been already mentioned that a Sun-bird occurs in Palestine, where there seems to be a certain intrusion, as it were, of the Indian Avifauna into that of the Palearctic region, for the Indian Fish-Owl (*Ketupa ceylonensis*) was also met with by Canon Tristram during his explorations in that country. Concerning the solitary species of *Cinnyris* known as the Jericho Sun-bird (*C. osea*), the latter gentleman writes an account as follows:—"Most residents in Palestine will tell you of the 'Jericho Humming-bird'—a true Humming-bird—and will not allow you to doubt the fact of its

* Gould: "Handbook to the Birds of Australia," I., p. 528.

† Shelley: "Monograph of the Sun-birds," Part X.

existence, as it has been seen by them, and was shot by the son of their friend or neighbour. They are not, however, so far astray as Mr. Gould's Devonshire friend, who held the honour of his country at stake in the maintenance of his assertion that Humming-birds were common there. Then these legends have the highest literary warrant: they are embodied in the journals of Lynch and M. de Sauley. The gallant commodore (certainly a most truthful narrator, and most trustworthily whenever on subjects within the range of his naval training and experience) saw the beautiful spangled 'Humming-bird,' between the Dead Sea and Kerak. M. de Sauley, yet more fortunate, not only saw in the Ghor es Safieh, at the south end of the Dead Sea, 'Humming-birds with ruby and emerald frills,' but afterwards obtained one of these wonders of the tropics, which, however, was never preserved, as an indiscriminating Cat carried it off from the dissecting table, where it had been left.

"Our acquaintance with the Sun-bird commenced on the last day of the year at Jericho, when six specimens were obtained, close to our camp at Ain Sultan, the day after our arrival. The oases of the



THE JERICHO SUN-BIRD. (After Wolf.)

plains of Jericho appear to be its metropolis, and we never met with it excepting in the immediate neighbourhood of water. But wherever a few tamarisks, zizyphus-bushes, or graceful 'retem' shade a fountain or straggling pool in some deep glen opening on the Dead Sea, there a few occur. The larger oases, however, of Jericho at the north-west, and Safieh at the south-east end of the Dead Sea, are the resorts of great numbers, which, though here to be found in almost every tree, are nowhere gregarious, but are noisy and pugnacious, the males chasing each other with loud cries, and as tenacious of their respective freeholds as Robins at home. The note is clear and monotonous, very much like the call of the Willow Wren, but sharper, and often reminding one of the Blue Tit, yet with a more hissing sound. This is incessantly repeated from sunrise

to evening, and the whereabouts of the male bird can at once be detected; but to see him is not so easy, as he ceaselessly hops in the centre of the very thickest and most impenetrable scrub, and darts very quickly and suddenly across the open from tree to tree. The male is extremely restless, and as it twists and clings to one twig after another, in search of insects, reminds one of the Titmouse much more than of the Creeper in its actions. It has a curious jerking flap of the wings, opening and shutting them like the Wall Creeper (*Tichodroma muraria*). Occasionally I have seen two rivals for the favours of a female singing on the top of a tree, and puffing out the brilliant orange and red axillary tufts, which only at such times are at all conspicuous. The female during the winter continually repeats the same monotonous note, but almost always remains stationary, or creeping slowly about in the very centre of a bush. One female had her quarters in a dense zizyphus-tree fifty yards from our tent, and was used as a decoy-bird by one of our party, who used to go and sit under the tree every morning for a fortnight, and would bring back two or three males, allured to their destruction by this fatal siren, who never left her retreat at the report of the piece. Alas for humanity! on the morning of our departure her good service to this treacherous collector was rewarded by her own death, to be embalmed alongside of her many deceived admirers. . . . A few days after our visit to Carmel we again met with the Sun-bird in a deep gorge, the Wady Hamam, opening on to the plain of Gennesaret. Mr.

Cochrane and I pursued it in vain; but while searching among the cliffs for Vultures' nests, Mr. Cochrane pulled down from the extremity of the twig of a hyssop plant what he imagined to be an old nest of a Grass Warbler (*Drymois gracilis*). It had the external appearance of a loose ball of rubbish, such as might have been floated down by a sudden flood and caught in the branch of a tree. After tossing it about for some time he threw it towards me, and on examining it I was dismayed to find it a fresh nest, very firm and compact inside, with a small hole in the side, and containing two broken fresh eggs, elongated, of a greenish-white, with a zone of darker green-grey spots near the larger end. We searched in vain for another, and mourning our ill-luck, left the neighbourhood the next day. On the 23rd of May I returned to the same place, and while climbing up to a cave, the resort of the Rufous Swallow (*Hirundo rufula*), I struck with my head a little ball of straw and leaves attached to the extremity of a castor-oil plant, not two yards from the spot where Mr. Cochrane had found his nest. It contained three eggs, quite fresh, and was beautifully shaded both from the sun and from observation. I was fortunate enough to secure the male bird in full plumage. Close by was another nest, from which one young bird had been reared; and we watched the female feeding her young family of three in the hyssop overhead. I am inclined to believe that they had bred twice, for we could not make out a third pair. Meanwhile, I had returned in April to our old quarters at Ain Sultan, near Jericho, accompanied only by a single muleteer and one guard. On the afternoon of my arrival, on the 13th of April, I discovered by myself no less than seven nests—one with three eggs, one with two hard set, one building, and four with young. All were in precisely similar situations, suspended from the extremity of a small twig hanging down in the centre of a 'nubk' tree, whose thorny branches spread in a circle so close to the ground that I had in every instance to creep on all-fours till I could get under the trees. The nests in these places were perfectly inaccessible to the attacks of the serpents and lizards which abound there. The nests are at first very neat and compact, long straws and fibres being attached to the extremity of the drooping bough, and on these the bag is woven. When finished, a few loose leaves and straggling straws are loosely fastened all round, to elude observation and remove the appearance of art. I kept three young birds for ten days in a box, and fed them with bunches of the blossom of a jasmine and convolvulus. The hen bird lingered always in the neighbourhood of the tent, doubtless attracted by their cries; and when we were about to leave I turned out the two surviving captives, and was glad to see the parent take to them at once, and attend to them in an adjoining tree."*

THE SECOND SUB-ORDER OF THE PASSERIFORMES. THE FRINGILLIFORMES, FINCH-LIKE BIRDS.

All the members of the Fringilliform group of perching birds have only nine primary quills, the first being very long, as may be seen in the subjoined sketch of a Pipit's wing. The families which make up this sub-order are seven in number, and it is difficult to arrange them in any successive order, for they are all more or less closely related to other forms which are placed in one or other of the remaining orders of the Passeriformes. Thus the Wagtails and Pipits (*Motacillidae*) are nearly allied to the Larks (*Alaudidae*), the American Warblers (*Mniotiltidae*) to the true Warblers (*Sylviidae*), the American Creepers (*Certhiidae*) to the true Creepers, or *Certhiimorphae*, the Flower-peckers (*Dicaeidae*) to the Sun-birds (*Cinnyrimorphae*), the Swallows (*Hirundinidae*) to the Flycatchers (*Muscicapidae*), the Finches (*Fringillidae*) to the Weaver-birds (*Ploceidae*), and the Hang-nests (*Icteridae*) to the Starlings (*Sturnidae*). As it is obvious that all these relationships cannot be shown in a linear arrangement, each family will have to be considered separately, and its relations explained as the work progresses. In fact, it is impossible in any way to arrange the families of birds in a straight line, any more than one can range the countries of Europe in direct succession, a fresh start having to be made every now and then.



WING OF PIPIT, SHOWING THE LONG SECONDARIES.

* "Ibis," 1865, p. 72.

THE FIRST FAMILY OF THE FINCH-LIKE BIRDS.—THE MOTACILLIDÆ.
WAGTAILS AND PIPITS.

These birds can always be recognised by a striking peculiarity of the wing, which, in addition to their habits and general economy, proclaims at a glance their Lark-like affinity. In the Wagtails and Pipits the innermost secondaries are of extreme length, nearly equalling the long primaries. This is a feature which is very pronounced in all Larks, like which birds, also, the Wagtails and Pipits seek their food on the ground, have large feet in proportion to their size, and progress by walking instead of by hops. Some of the Pipits, too, have the habit of mounting into the air and uttering their song, much the same as a Woodlark would do, though not to the same extent as a Skylark. The eggs of the Pipits likewise resemble to a great extent those of a Lark.

The Wagtails may be recognised from the Pipits by their longer tail, which exceeds the wing in length, whereas in the last-named group of birds the wing is either equal to the tail or exceeds it in dimensions. They may be divided naturally into two groups, called the Pied, or *Water Wagtails* (*Motacilla*), and the *Field Wagtails* (*Budytes*). As a rule, the prevailing colours in the latter group are grey and yellow, and they have rather shorter tails, but it is doubtful whether more than one genus of Wagtails can properly be recognised, for there is an intermediate form, the Grey Wagtail (*Motacilla melanope*), which combines the habits and form of an ordinary Water Wagtail with the grey and yellow coloration of a Field Wagtail.

THE PIED WAGTAIL (*Motacilla lugubris*).

This is one of our peculiarly English birds, being one of the few European species which is common in the British Islands and rare in other parts of the Continent; this, at least, is true as regards the breeding season. In the south of England it is a resident bird, though the numbers decrease in very severe weather, when the bird probably migrates, for in Western Scotland it may be looked upon as a regular migratory species, as it has been stated to disappear entirely from its summer haunts in the outer Hebrides, where it returns again in spring. It was at one time supposed to be only a native of Great Britain, and is even to this day best known by the name of *Motacilla yarrelli*, having been thus called by Mr. Gould, after the celebrated English naturalist Yarrell. In the part of Berkshire near Cookham, where many of the writer's personal experiences of birds have been gathered, the Wagtail is the especial victim of the Cuckoo, many of whose eggs he has found in the nest of the Pied "Dishwasher," as he is familiarly called in that and in most parts of the country. On one occasion the nest was built in the mould of a flower-basket on the lawn at Formosa, near Cookham, and at some distance from the edge of the wood-work. There the nest was found by Mr. Briggs, the head-gardener on the estate, one of the best field-naturalists known to the writer, as indeed is testified by the frequent references to his observations in Mr. Gould's "Birds of Great Britain," and to this day his untimely death is deplored by all who knew him. The Cuckoo's egg was duly pointed out by Mr. Briggs, but so exactly alike in colour was it to the other eggs of the foster-parent, that the writer expressed the strongest doubts as to its being really anything but a rather large Wagtail's egg. Time, however, proved the contrary, and it was not long before the nest, which was rather a rudely constructed affair, placed in a hollow depression in the mould of the flower-basket, was completely filled by a hungry, yellow-gaping, young Cuckoo, who, on being hatched, disposed in the usual cuculine way of his foster-brothers and sisters. These were found, curiously enough, lying dead on the grass at some little distance from the flower-basket, and the question which was asked was, whether the old Cuckoo really is the unregenerate deserter of its offspring that it is generally made out to be, or whether it still takes a parental interest in the young birds, which it nevertheless leaves to the care of foster-parents to bring up. Mr. Briggs always held the idea that the Cuckoo was not devoid of this natural instinct, and he imagined that the removal of the young Wagtails was the work of one of the parents of the young Cuckoo. It is, however, probable that the old Wagtails, finding the dead bodies of the nestlings left on the mould, themselves acted as undertakers, and carried them to some little distance. All the time that the nest was under examination the Wagtails were in close attendance, with their mouths full of caterpillars and insects, evincing the utmost distress, and running about on the edge of the flower-basket. Mr. Gould even

says that they will fly in the face of any one attempting to remove their unwieldy foster-child, and that when the latter is restored to the nest they "will evince their joy by fondling and dancing around it, leaping over its back, and exhibiting many other demonstrations of delight."

The following excellent description of the Wagtail's habits is given by Macgillivray :—

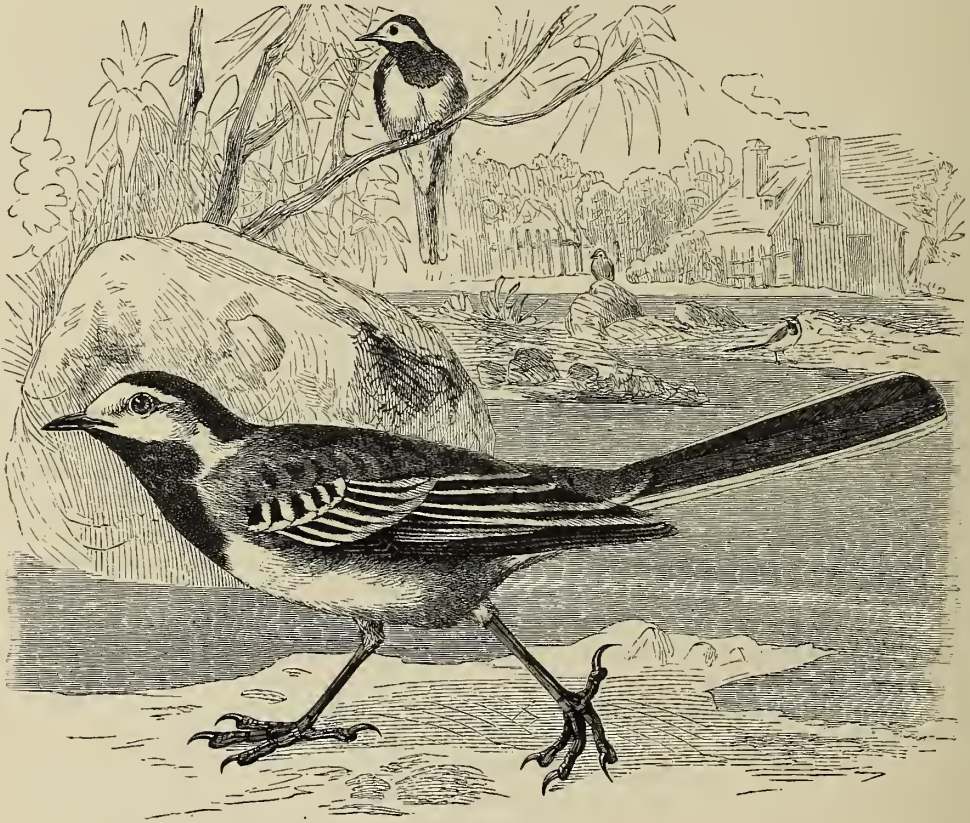
"The places usually frequented by this beautiful bird are the margins of streams, ditches, pools, and lakes. Towards the end of July, when the cares of rearing their young are over, they betake themselves in great numbers to the mouths of rivers, especially such as have marshy meadows along their sides, or muddy expanses to which the tides have access. Often one may see them wading in shallow places in quest of insects and worms, carefully holding up their tail to prevent its being dragged. If you watch the motions of an individual just coming up to join the party, you see it alight abruptly, twittering its shrill notes, and perching on a small stone, incessantly vibrate its body and jerk out its tail. It now perhaps walks out into the water and searches for food, or, finding none, flies to the shore, and runs along with great rapidity, stopping and stooping now and then to pick up a tiny wormlet, and momentarily spreading out its ever-vibrating tail. Its light footsteps leave no impression on the soft sand, and if it walks out upon the mud you wonder that its little toes do not get clogged; yet so rapid are its motions that it never sinks in the mire, and when the latter becomes too soft it aids itself with its wings or flies to a place where it may find more secure footing. Now it runs into the meadow, in pursuit of a fly, which it has no sooner caught than it spies another. The lazy geese that have nibbled the grass bare allow it to pass in the midst of them without molestation, or if some malicious gander or foolish gosling attempts to seize it, they find that they have given themselves too much credit for dexterity. There the cows are grazing in the midst of a swarm of gnats and other insects, and the Wagtail has arrived in their vicinity. Running forward, it catches a small fly, bends to one side to seize another, darts to the right after a third, and springs some feet into the air before it secures a fourth. Now see it picking among the old dung, where there are doubtless many larvæ concealed, again running off in pursuit of a fly, passing close to the cow's nose or among her feet. There, while in pursuit, it encounters another of its own species; but they quarrel not, no doubt aware that there is room enough for both of them in the world, or even in the meadow, which you now see to be covered with Wagtails, all busily occupied, some walking, others running, a few flying off, and many arriving. You may walk in among them: they are not very shy, for they will allow you to come within fifteen yards, or sometimes less; and you may shoot as many as you please, for although some will fly off, others will remain, and of the former a few will settle in the neighbourhood. Day after day you will find them here when the tide is out. At other times you may search for them by the edges of the river, along the mill-dam, in the meadows, or even in the dry pastures. Occasionally you may see them perched on a roof, a wall, or a large stone, but very rarely on a tree or bush. Towards the middle of October many of them take their departure from the middle and southern parts of Scotland, and the rest wander over the country, frequenting watery places, and in hard weather approaching houses, searching the sides of the roads, the dunghills, and even the cottage doors. In most parts of the south of Scotland they are not at all uncommon in winter, but in England they are much more abundant.

"About the beginning of March the migratory movement commences. Many remain in the south, but many also move northward, and some arrive in the northernmost parts of Scotland and in the outer Hebrides by the middle of March. It is a pleasant sight to see a small group of these birds walking and running with light and graceful steps along the newly-turned furrows on a cold, dry morning in spring, when the east wind nips your fingers and calls the blood into your cheeks. Rooks are scattered over the field; a few Hooded Crows are searching the distant end of the ridge, but they have little dread of the ploughman, follow close upon his heels, or merely rise before the horses, to resume their station when they have passed. At this season they obtain an abundant supply of food, and as the labouring lasts until the warm weather sets in, they need never suffer for lack of larvæ or insects. But at all seasons they are fond of rambling along the shores of the sea, and especially of estuaries, lakes, and rivers.

"About the middle of April, when they have paired and scattered over the country, they begin their preparations for the more important business of the season. Their nests are placed by the side of a river or stream, on a rocky bank, or among the grass, or on a heap of stones, or in a hole in a

wall, and are composed of stems and leaves of withered grasses, mixed with some moss and leaves, and thickly lined with wool and hair, sometimes also with feathers. One now before me is of a somewhat flattened form, rather bulky and rudely constructed, its external diameter five inches, the internal three and a half. The outer layer is composed of fibrous roots, stems and blades of grasses, intermixed with hair. The inner is a rude mass of hair of various kinds in tufts : human hair, black, brown, red, and sand-coloured ; hair of dogs, cats, cows, and horses ; hog's bristles, and some cotton, thread, and feathers. The eggs, five or six in number, are greyish-white, spotted all over with grey and brown, their average length nine-twelfths of an inch, their greatest breadth seven and a quarter twelfths.

“The ordinary note of this species is a sharp chirp. When alarmed or otherwise agitated, it flies



THE WHITE WAGTAIL.

about in a wavering manner, uttering a repetition of this note, and alarming the small birds in the neighbourhood. In sunny weather, especially in the mornings, it may be heard singing a pleasant, mellow, and modulated little song. The flight is light, buoyant, and undulated ; it propels itself by a repetition of smart flaps, ascends in a curved line, then ceases for a moment, descends in a curve, repeats the motion of its wings, and thus proceeds, as if by starts, and with great velocity. Like many other birds, it is not fond of flying down the wind, but prefers an oblique course. In its habits it is quite terrestrial ; at least, I have never seen it search for food on trees, bushes, or even herbaceous plants, although it not unfrequently perches on a hedge or bush during the breeding season. It is curious to observe this species pursuing its prey in different localities. Thus, if you watch it for some time when it has taken its station among stones or fragments of rock, you cannot fail to be pleased with the activity and dexterity which it displays. There it stands on the top of a stone, gently vibrating its tail, as if poising itself. An insect flies near, when it starts off, flutters a moment in the air, seizes its prey, and settles on another stone, spreading and vibrating its tail. Presently it makes another sally, flutters about for awhile, seizes two or three insects, glides over the ground, curving to either side, and

again takes its stand on a pinnacle. Again, you perceive several Wagtails flying in a wavering and buoyant manner over the rushes that skirt a large pool. It is a calm bright evening, the Coots are swimming about among the reeds and horsetails, uttering now and then their short, loud, trumpet-like cry, and the White-rumped Swallows are glancing along, now dipping lightly into the water to seize a fly, then darting here and there amongst the tiny insects that sport over the rank weeds. A Wagtail tries an excursion over the water, and although its flight does not equal that of the Swallow in elegance and velocity, it yet performs its task with considerable grace, flutters here awhile, seizing a few insects, sweeps away in a curve, as if to acquire sufficient speed to keep it up without fluttering, turns suddenly, then shoots forth in a straight line, and thus continues for several minutes, until at length, fatigued, it betakes itself to the top of the stone wall, where it rests a little, and then commences a new excursion. Not unfrequently it may be seen running along the roof of a house in search of insects, which it seizes in the manner of the Flycatcher or Redstart. Often also it is to be found among rocks, and it is not uncommon in the streets of country villages, where it searches for insects, chiefly along the gutters."

Under the heading of a "Season Ticket," the following story went the round of the papers in the summer of 1878 :—"It may be interesting to some of your readers to be informed that on a small piece of framework underneath a third-class smoking carriage on the London and South Western Railway, a Water Wagtail has built her nest and reared a young and thriving family of four. The train runs regularly from Cosham to Havant five times a day, in all about forty miles; and the station-master informs me that during the absence of the train the male bird keeps close to the spot, waiting with manifest interest and anxiety the return of his family from their periodical tours."

THE SECOND FAMILY OF THE FINCH-LIKE BIRDS.—THE CÆREBIDÆ.

AMERICAN CREEPERS.

There is a great difference in the outward aspect of the American Creepers and the true Creepers of the Old World, which have spiny tails; the former rather approach the Nuthatches, like which birds, most of them have soft-feathered, squared tails. In fact, in Southern and Central America there is a genus *Diglossa*, which is wonderfully like *Sitta* in appearance, but with a hooked and rather upturned bill. To the present family belong also the pretty little Blue Creepers, which are so often mounted in glass shades, and seen, alas! on hundreds of ladies' bonnets in this country, and which are remarkable for their vivid blue colour and yellow-spotted wings. Another interesting group is seen in the genus *Certhiola*, the members of which are principally Central American, though some species extend southwards as far as Brazil.

THE BANANA QUIT (*Certhiola flaveola*).

For the habits of this interesting little bird, a reference must be made to the well-known work of Mr. Gosse on the "Birds of Jamaica."* "Scarcely larger than the average size of the Humming-birds, this little Creeper is often seen in company with them, probing the same flowers and for the same purpose, but in a very different manner. Instead of hovering in front of each blossom, a task to which his short wings would be utterly incompetent, the Quit alights on the tree, and proceeds in the most business-like manner to peep into the flowers, hopping actively from twig to twig, and throwing the body into all positions, often clinging by the feet, with the back downwards, the better to reach the interior of a blossom with his curved beak and pencilled tongue. The minute insects which are always found in the interior of flowers are the objects of his search and the reward of his perseverance. Unsuspectingly familiar, these birds often resort to the blossoming shrubs of gardens and yards. A large moringa tree, that is all through the year profusely set with fragrant spikes of bloom, is a favourite resort both of these and the Humming-birds. One within a few feet of my window is, while I write this note, being carefully scrutinised by two active little creatures that pursue their examination with a zeal perfectly undisturbed by my looking on, while the same blossoms are rifled on one side by a

* "Birds of Jamaica," p. 84.

minute Humming-bird, and on the other by that gorgeous Butterfly, *Urania sloaneus*—an interesting association. The Quit often utters a soft, sibilant note as it peeps about.

“The nest of this bird is very frequently, perhaps usually, built in those low trees and bushes from whose twigs depend the paper nests of the brown wasps, and in close contiguity with them. The Grass Quits are said to manifest the same predilection; it is a singular exercise of instinct, almost of reason, for the object is doubtless the defence afforded by the presence of the formidable insects, but upon what terms the league of amity is contracted between the neighbours I am ignorant.

“It is in the months of May, June, and July that the Creeper performs the business of incubation. On the 4th of May I observed a Banana Quit with a bit of silk cotton in her beak, and on searching, found a nest just commenced in a sage-bush (*Lantana camara*). The structure, though but a skeleton, was evidently about to be a dome, and so far was constructed of silk cotton. Since then I have seen several completed nests. One now before me is in the form of a globe, with a small opening below the side. The walls are very thick, composed of dry grass, intermixed irregularly with the down of asclepias. It appeared to have been forsaken, from my having paid it too much attention. It was fixed between the twigs of a branch of a bawhinia, that projected over the high road near Content, in St. Elizabeth's. Another, which I found at the end of June in a sage-bush, was of the same structure; in this were two eggs, greenish-white, thickly but indefinitely dashed with reddish at the larger end.”

THE THIRD FAMILY OF THE FINCH-LIKE BIRDS.—THE MNIOTILTIDÆ. AMERICAN WARBLERS.

The American Warblers are similar in form and also in habits to the Warblers of the Old World, but, as already stated, they have no “first” or “bastard” primary, as it is called, so that they must be placed in quite a separate sub-order of the Perching Birds. They are of a more vivid coloration than their more sober-plumaged Old World cousins, many of them having a beautiful admixture of yellow, black, chestnut, and white in their plumage. Many of them are closely allied to some of the American Creepers (*Certhiidae*), but are distinguished by a shallow notch at the end of the tongue, instead of the deeply-fissured tip which is the characteristic of members of the last-mentioned family.* Some of the American Warblers are extremely rare, and appear to be local in their distribution; they seem, however, to be nearly all migratory, many of them spreading over a wide extent of North America during the summer, and taking up winter quarters in Central America, some even extending to South America.

THE SUMMER YELLOW BIRD (*Dendroica aestiva*).

Dr. Brewer writes:—“The Summer Yellow Bird arrives in New England with great uniformity from the 1st to the middle of May. Its coming is usually the harbinger of the opening summer and expanding leaves. Unlike most of its family, it is confiding and familiar, easily encouraged, by attention to its wants, to cultivate the society of man. It confidingly builds its nest in gardens, often in close vicinity to dwellings, and in the midst of large villages and cities, among the shrubbery of frequented parks. This Warbler, soon after its arrival, begins the construction of its nest. It is usually placed in low bushes, three or four feet from the ground. Occasionally very different positions are chosen. Hedges of buckthorn and hawthorn, barberry-bushes, and other low shrubs are the favourite places of resort. On one occasion the nest was placed some forty feet from the ground in the top of a horse-chestnut tree overhanging the main street of a village. Such high positions are, however, not very common. The nest is invariably fastened to several twigs with great firmness, and with remarkable neatness and skill. A great variety of materials is employed in the construction of their nests, though not often in the same nest, which is usually quite homogeneous. The more common materials are the hempen fibres of plants, fibrous strips of bark, slender stems of plants and leaves, and down of asclepias. Interwoven with these, forming the inner materials, are the down from willow catkin, the woolly furze from fern-stalks and the *Eriophorum virginicum*, and similar substances. These are lined with soft, fine grasses, hair, feathers, and other warm materials. Cotton, when procurable, is a favourite material, so also is

* Baird, Brewer, and Ridgway: “North American Birds,” Vol. I., p. 177.

wool; where abundant, I have known instances where nests were built almost exclusively of one or the other material. A pair of these birds, in 1836, built their nest under a parlour window in Roxbury, where all their operations could be closely watched. When discovered, only the framework, the fastening to the supporting twigs, had been erected. The work of completion was simple and rapid. The female was the chief builder, taking her position in the centre of the nest and arranging the materials in their places as her mate brought them to her. Occasionally, with outstretched wings and expanded tail, she would whirl herself round, giving to the soft and yielding materials their hemispherical form. At intervals she arrested her revolutions to stop and regulate with her bill some unyielding portion. When her mate was dilatory, she made brief excursions and collected materials for herself, and when the materials brought her were deemed unsuitable they were rejected in a most summary and amusing manner. The important part of the tail-feathers in shaping the nest and placing the materials in position was a striking feature in this interesting performance. The greater portion of the nest was thus constructed in a single day. The wonderful sagacity displayed by this Warbler in avoiding the disagreeable alternative of either having to abandon its own nest or of rearing the young of the intrusive Cow Blackbird, when one of these eggs is dropped into her nest, was first noticed by Mr. Nuttall. The egg of the parasite, being too large for ejection, is ingeniously incarcerated in the bottom of the nest, and a new lining built over it. Occasionally, either by accident or design, the intrusive egg has been fractured. Mr. Nuttall states that when the parasitic egg is laid after her own, the Summer Yellow Bird utterly refuses to act the part of a foster-parent, and rather than do so sacrifices her own eggs. So far as I know, this Warbler will never sit upon or hatch out the egg of the Cow-bird under any circumstances. Some powerful instinct, bordering closely upon reason, seems to teach these intelligent Warblers the character of the intruder, and they sacrifice their own eggs rather than rear the parasite. In this dilemma they will always, so far as I know, incarcerate their own eggs with the Cow-bird's, and re-construct the nest above them. In one instance, the same pair of Yellow Birds, twice in the same nest, covered up alien eggs in this manner, building, in fact, three nests one above the other, between the walls of which had been successfully included two eggs of the Cow-bird. This three-storeyed nest measured seven inches in length, and was built almost exclusively of raw cotton. The covering of the imprisoned eggs was about two-thirds of an inch thick. In both instances the Cow-bird's eggs had been broken, apparently by design. So far as I am aware, this Warbler raises but one brood in Massachusetts in a season. In Pennsylvania it is said to raise two, and even three. The eggs are usually five and occasionally six in number. This Warbler is conspicuous in its devotion to its young, evincing a strong attachment and an anxiety even in regard to an occupied nest, and betraying the site by this solicitude. They will also resort to various expedients to draw one away from their nest by feigned lameness and other stratagems and manœuvres.

"The song of the Summer Yellow Bird is simple but pleasing, and is easily recognised when once known, though liable to be confounded with that of the Maryland Yellow Throat, and also said to resemble the song of several other Warblers.

"In confinement they usually become very tame, confiding, and reconciled to their imprisonment, and have been known to perch on an outstretched finger and to catch flies in a room. Their eggs vary in length from .61 to .70 of an inch, and in breadth from .49 to .52. They have a ground-colour of a light green. Their dots and blotches vary greatly in number, size, and manner of distribution. Their colours are light purple, darker purplish-brown, and other shades of brown and lilac."

CHAPTER V.

THE FLOWER-PECKERS—THE CHATTERERS—THE SWALLOWS—THE TANAGERS— THE TRUE FINCHES—THE HANG-NESTS.

THE FLOWER-PECKERS—The Bornean Species—THE AUSTRALIAN FLOWER-PECKER—THE CHATTERERS—Characters—THE BOHEMIAN WAXWING, OR WAXEN CHATTERER—Superstitions regarding it—Professor Newton's Account of Mr. Wolley's Discovery of its Nest and Eggs—Description of the Bird—THE SWALLOWS—Professor Garrod's Explanation of the grounds for placing Swallows and Swifts in Separate Orders—THE ROUGH-WINGED SWALLOWS—THE SMOOTH-WINGED SWALLOWS—The Three English Species—THE COMMON SWALLOW—Harbinger of Summer—Buffon's Anecdote—Migrant—Usefulness—Nest—THE TANAGERS—Insect Eaters—Brilliant Plumage—Species—THE SCARLET TANAGER—Dr. Brewer's Account of its Habits—THE TRUE FINCHES—The Two Sections—Palate Characters—Nest of Chaffinch—Nesting of Bullfinch—Palate and Bill Characters in Buntings—THE CROSSBILLS—Habits—Curiously-formed Bills—Longfellow's "Legend of the Crossbill"—THE HANG-NESTS—The Three Sub-Families—Habits of the Cow-bird—THE BALTIMORE ORIOLE—Dr. Brewer's Description of Its Habits—THE BOAT-TAIL.

THE FOURTH FAMILY OF FINCH-LIKE BIRDS.—THE DICAÏDÆ—FLOWER-PECKERS.

THESE beautiful little birds, of which a large number are known, are almost exclusively Indian and Australian, only two species being found in Africa, where they are confined to the forest region of the west coast; these are *Pholidornis ruficollis* and *P. rubrifrons*. Their habits are described as being very similar to those of the English Titmice and Gold-crests. They build very beautiful nests, like a purse. Mr. Motley thus describes the Bornean species, the Black-chinned Flower-pecker (*D. nigrimentum*)*:—

"These little birds are not uncommon in Labuan, and have something of the habits of the English Regulus; they haunt low brushwood, and continually utter a low, shrill chirp. They are very fearless, allowing themselves to be almost touched before they take to flight. The Malay name, which signifies Spark Bird, is very appropriate, as, when darting about among the bushes, the cock bird really looks as bright as a flash of fire. The nest of this species is about the shape and size of a goose's egg, and is suspended by the small end from some slender twig of a tall tree. It is built of fine green moss and a sort of brown byssus, and lined with some white fibre and a few small feathers. One of these nests was found on a tree which was felled in the jungle, and all the young birds, however, except one, had been killed by the fall. The survivor was brought to Mrs. Motley, who succeeded by great care in bringing it up, feeding it at first upon rice and banana pulp. As soon as it was strong enough it was placed in a small cage. Though very restless, never being for one moment still, it was perfectly tame and fearless, and would sit upon the finger without attempting to fly away; and though its whole body, feathers and all, might have been shut up in a walnut, it would peck at a finger held towards it with great fierceness. For a long time it would only take food from the hand, but afterwards, when food was given it, it dropped, and shook its wings rapidly, as we see a hen Partridge occasionally do. At first its beak was short, straight, and sharp, but as it grew its form gradually changed to that of the adult Dicaeums; it also changed its diet altogether, refusing rice, and only occasionally taking plantain. For some weeks it fed exclusively upon sugar and water, which it sucked up like a Humming-bird. It was very fond of bathing in a large shell full of water placed in its cage."

THE AUSTRALIAN FLOWER-PECKER (*D. hirundinaceum*).

Mr. Gould writes †:—"By far the greater number of the Australians are, I believe, unacquainted with this beautiful little bird, yet there is scarcely an estate in either of the colonies in which it may not be found, either as a permanent resident or an occasional visitor. Its natural disposition, leading it to confine itself almost exclusively to the topmost branches of the loftiest trees, is doubtless the cause of its not being more generally known than it is, its rich scarlet breast not even attracting notice at the distance from the ground at which it generally keeps; and in obtaining specimens I was more frequently made aware of its presence by its pretty warbling song than by its movements among the branches: so small an object, in fact, is most difficult of detection among the thick foliage of the lofty *Casuarinæ*, to which trees it is extremely partial,

* Motley and Dillwyn: "Nat. Hist. Labuan," p. 18.

† "Handbook to the Birds of Australia," Vol. I., p. 581.

particularly to those growing on the banks of creeks and rivers. It is also frequently to be seen among the clusters of the beautiful parasitic *Coranthus*, which is very common on the *Casuarinæ* in the neighbourhood of the Upper Hunter. Whether the bird is attracted to this mistletoe-like plant for the purpose of feeding upon its sweet and juicy berries I could not ascertain; its chief



THE AUSTRALLIAN FLOWER-PECKER, OR SWALLOW DICAËUS. (After Gould).

food is insects, but in all probability it may occasionally vary its food. The Swallow *Dicaeum* has neither the actions of the *Pardalotes* nor of the Honey-eaters; it differs from the former in its quick, daring flight, and from the latter in its less prying, clinging, and creeping actions among the leaves, &c. When perched on a branch it sits more upright, and is more Swallow-like in its contour than either of the forms alluded to; the structure of its nest and the mode of its nidification are also very dissimilar.

"Its song is a very animated and long-continued strain, but is uttered so inwardly that it is almost necessary to stand beneath the tree upon which the bird is perched before its notes can be heard.

"It would appear that the range of this species extends to all parts of the Australian continent, since I have received specimens from every locality yet explored. I found it breeding in the Lower Namoi, which proves that the interior of the country is inhabited by it as well as those portions between the ranges and the coast."

Mr. White, of the Reed Beds, near Adelaide, says:—"This little bird is sometimes rather numerous here. It appears to be wholly frugivorous, for all of those I have dissected had fruit in them. It has no regular stomach, not even an enlargement of the intestine, which averages about five inches and a half in length, and through which the food passes whole. It arrives at Adelaide about February, and stays but a short time. I have met with it very far north."

Its beautiful purse-like nest is composed of the white cotton-like substance found in the seed-vessels of many plants, and among other trees is sometimes suspended on a small branch of *Casuarina* or an *Acacia pendula*. The ground-colour of the eggs is dull white, with very minute spots of brown scattered over the surface; they are nine lines long by five lines and a half broad.

The male has the head, all the upper surface, wings, and tail black, glossed with steel-blue; primaries black; throat, breast, and under tail-coverts scarlet; flanks dusky; abdomen white, with a broad patch of black down the centre; irides dark brown; bill blackish-brown; feet dark brown. The female is dull black above, glossed with steel-blue on the wings and tail; throat and centre of the abdomen buff; flanks light brown; under tail-coverts pale scarlet.

THE FIFTH FAMILY OF THE FINCH-LIKE PERCHING BIRDS.—THE AMPELIDÆ. CHATTERERS.

The true Chatterers are a small group of birds, of which the Bohemian Waxwing and the Cedar Bird of America are the familiar examples. Some naturalists place along with these birds, the sole representatives of the genus *Ampelis*, a few Central American genera, which probably belong to the family, but are not *Wax-wings*. The characters which distinguish the *Ampelidæ* are a short and rather stout bill, a little widened, with a nearly obsolete hook, and faint indications of an incision near the tip of the bill; the plumage is very soft and silky; the wing is long, but the tarsus is very short. Even admitting the five supposed Central American species of Central American Chatterers, the whole family contains only eight species, of which two are confined to the Palearctic region, the best known being—

THE BOHEMIAN WAXWING, OR WAXEN CHATTERER (*Ampelis garrulus*).

This bird gains its name of Waxwing from the beautiful ornamentation which appears on the secondary quills, and there takes the form of an elongated drip of sealing-wax, which is also occasionally, but more rarely, developed on the tail-feathers. The home of the Waxwing extends throughout the northern parts of Europe, Asia, and North America, and a considerable migration takes place in winter, sometimes in such numbers that the bird is supposed in some of the countries of Central Europe to be the precursor of famine or pestilence, and this circumstance has gained for it in Holland the name of *Pestvogel*. It is difficult, at a distance of twenty years, to imagine the excitement which existed in former days amongst zoologists concerning the nest of the Waxwing, and the first authentic record that was published of the breeding of this bird was an account of the researches of the late Mr. John Wolley, to whose indefatigable zeal the world is indebted for positive information of the nidification of a great number of the rarer European birds. Professor Newton has told the story of Mr. Wolley's success in finding the Waxwing's nest. "It is unnecessary to repeat here the fabulous accounts given by former writers respecting the nidification of this bird. The very plain statement communicated by Mr. Wolley to the Zoological Society on the evening of the 24th of March, 1857, is sufficient to set them at rest for ever. But still I may remark that from the days of Linnæus (who said of it, '*Nidus in rupium antris*') downwards, nearly all the conjectures published seem to have been wide of the mark. In years gone by, one of the hardiest of our Arctic explorers, Sir John Richardson, had failed to ascertain anything connected with its breeding in the far countries of the north-west; and, more recently, the intrepid Siberian traveller, Dr. A. Von Middendorf, was unsuccessful in the north-east. Yet it may be safely said that there was no bird whose egg was so

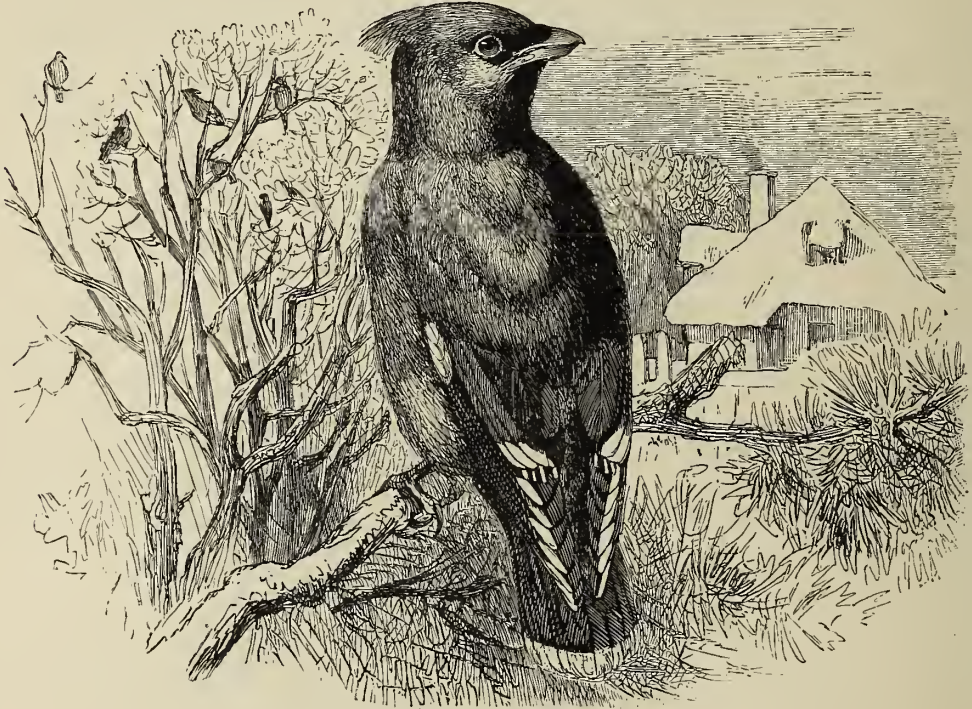
* "Ibis" for 1861, p. 93.

longed for by the ornithologists of the whole world. Various were the plans they bethought them of for attaining this *desideratissimum*. Many tried to keep pairs of living birds, in the hope of inducing them to breed in confinement. One enthusiastic egg-collector, Baron R. Von König-Warthaussen, we are told, even went to the trouble of caging a whole flock. It is true that here and there an oologist might be found with whom the 'wish was father to the thought,' and who accordingly deluded himself into the belief that in some unusually large specimen of the egg of the allied species (*Ampelis cedrorum*), or in some queerly-coloured monstrosity of a bird, perhaps not at all connected, he recognised a genuine production of *Ampelis garrulus*; but such instances were certainly exceptional, and there can be little doubt that prior to 1856 no one with any pretension to the title of naturalist had ever set eyes on a real egg or nest of the Waxwing, and that this privilege was reserved for one who of all men eminently merited it. It is due, however, to Scandinavian naturalists to say that several of them who had travelled in Lapland had expressed themselves confident that the bird did sometimes breed in that country; and though the reports of its nesting which some of them brought home have been shown by Mr. Wolley's discovery to be probably incorrect, yet it was, I think, reliance on the general fidelity of those gentlemen in matters of this kind which kept alive my friend's hopes of one day finding the long-sought treasure: but hopes they were of a kind so remote, that when they were fulfilled he was justified in speaking of the discovery as 'unexpected.'

"The first intimation I received from Mr. Wolley that the discovery was accomplished was contained in a letter written by him on his way up the Baltic, and dated 2nd September, 1856. He says:— 'Let me tell you now, whilst I think of it, that I have some reason for believing that the Waxwing makes its nest in good-sized fir-trees in the month of June. I give you this hint in case I should not live to give you more certain information; but you remember that I am not to return home without a Waxwing's nest in my hand.' He had, in fact, a few days before, when at Stockholm, received from his faithful Ludwig a letter telling him of the discovery, in which Ludwig had himself assisted, and respecting the truth of which he said, his 'master must be quite sure—without doubt.' Mr. Wolley, however, forbore to allow his own or my expectations to be raised too highly, and in spite of his receiving confirmatory evidence on his arrival at Haparanda and on his way up the river, it was not until he had reached Muoniovara, and had satisfied himself by repeated investigation of the whole story, that he trusted himself to write to me positively. His letter, dated 'Muoniovara, 14th September, 1856,' after describing his own doings and those of the friends I had made the preceding year, telling me of the expected scarcity of food, and giving the general results of the nesting season, goes on to say:—

" 'I have still to tell you of Ludwig's expedition with Piko Heiki to Sardio, on the Kittila River. It was early in June, and he had to wade over Pallas-tunturi up to his middle in snow. Arrived at Sardio, he found there all at home, deep in dirt and laziness. He soon extracted from them the information that a pair of birds had been about, which they took to be *Tuka vastas*; and Ludwig himself had seen such a bird, and this bird's egg was entered in my list. . . . Ludwig immediately started off into the forest, and sure enough he saw a bird which he thought was *Silensvans*; but he was not quite sure, for the end of its tail looked white in the sun instead of yellow, as in your picture, but the next day, or in the evening, it was cloudy, and Ludwig saw the yellow; and now he had no longer any doubt. He said he would give all the lads day-money, and they must all search, even if it were for a week, till they found the nest. They sought all that night and the next day till about midday, when a lad called out that he had found the nest; and there it was, with two eggs, about nine feet high on the branch of a spruce. . . . After five days Ludwig snared the old bird—a beautiful cock; and you may fancy with what pleasure I took it in my hand and saw that there were no doubts remaining. Indeed, I had before been pretty confident about it: Ludwig had written that I might be quite satisfied that it was the right bird. Martin Pekka had the picture with him at Sodankyla, and as soon as he came back Ludwig compared the bird with it, and certainty was doubly sure. The other picture went to Gellivara. . . . I do not expect Waxwings in that quarter. You can fancy how eagerly I waited for Ludwig to produce the eggs. With a trembling hand he brought them out: but first the nest, beautifully preserved. It is made principally of black 'tree-hair' (lichen), with dried spruce twigs outside, partially lined with a little sheep's-grass and one or two feathers—a large, deep nest. The

eggs—beautiful! magnificent!!—just the character of the American bird. An indescribable glow of colour about them. Ludwig had made for them such a box, that even if a horse trod upon it it would not break. He tells me he happened to say that they were most like "*Sawirastas*" (common Thrush), and any one wishing to cheat should try that. The report seems to have spread, without the name of its originator being given; for in a week or two after the notorious Sallanhi Johan brought a *Korwa-rastas* (Waxwing), "shot from the nest," with its eggs—the eggs being, as Ludwig at once saw, common Thrush's. The next incident was the arrival of Johan's brother, the still more notorious Niku, but this time with a couple of young birds scarcely able to fly, which he had caught, as he said, out of a brood of five, by Pallas-tunturi. One of these Ludwig has stuffed, and a rare little beauty it is; the other was much knocked about, and Ludwig made nothing of it. Then a little girl, just ten



THE BOHEMIAN WAXWING.

days ago, brought three eggs from the other side of Nälma (about twenty-five miles from here), which she said were taken on a certain day in July, and were "*Kukhaisen*." They were undoubtedly Waxwing, but are very badly blown by her as they were just hatching. At Midsummer, Sardio Michel brought in a small batch of *Sidensvans*, with the birds (four in number) to each. So now I have a series, though but a very short one, of this *rara avis in terris*—this forerunner of famine, and of infinite value when one thinks of the uncertainty of getting it again. At the same time I should tell you the Sardio lads found a nest which they believe to have been a last year's *Korwa-rastas*. On this river no one has seen the bird of late years, and very few know it at all. One old fellow, Nalio Aaron, says he saw one north of Nälma in 1853, and another in 1854. Martin Pekka showed the picture to many people in the Sodankyla and Kittila districts, but he could not make out that the bird was at all known, and in all his journeys, when he kept a good look-out, he did not see one; so that even this year it seems to have come very sparingly and locally—just in the district north, east, and south of Pallas-tunturi. In 1853 I told you of a boy, Sieppis Johan, who described a nest of birds he had found some years ago, which, from my interpreter's version, I thought might be that of the Waxwing. The boy, on being shown a skin, said he had never before seen the bird.

"It is a relief to think that I am not bound to go to Russia next spring unless I like it, as I

before felt that I was. I almost think I may leave the unbounded riches of the Nova Zembla coasts and of the north of Siberia—their Steller's Duck, Curlew, Sandpiper, Little Stint, Knot, Sanderling, Grey Plover, Grey Phalarope—to younger adventurers. . . .

“Almost every day (and it is now the sixth since that of my arrival here) Ludwig has told me the whole story of the *Sidensvans*' nest, and I am never tired of hearing it:—How the season was very backward; how, in their expedition, he and Piko Heiki were getting very much out of spirits at the little success they met with. How he saw this bird in the sunshine. How, when at last the nest was found, he could scarcely believe his eyes; how he went to it again and again, each time convinced when at the spot, but believing it all a dream as soon as he was at a distance. The rising and falling of the crest of the bird, its curious song or voice—all he is eager to tell over and over again; and I have the fullest version, with all the “I said,” “he said,” “Michel said,” “Ole said,” &c. These Sardinian lads, as you have heard me say formerly, have a good knowledge of the small birds of their neighbourhood, but they are none of them sure whether they have ever seen *Sidensvans* before. As I have also told you, it seemed to be known to a very few woodsmen on that side of the country under the name of “*Korwa-rastas*” or “*Korwa-lintu*” (Ear-bird). It had occasionally attracted their attention as having feathers on its head standing up like Squirrel's ears. It was not till the second year of my stay here that I ascertained this with certainty. The first summer I believed it to be “*Harrhi*,” a bird coming in bad seasons, and properly the common Jay; but it seems that this name is also really sometimes given to *Sidensvans*, and therefore, as well as for other reasons, I am inclined to believe that the bird is only here very occasionally.”

The Waxwing is about eight inches in length, and is of an elegant form and coloration. The plumage is light greyish-brown, shading gradually off into blue-grey on the rump and upper tail-coverts, and the under surface is pale brownish-grey; the head is ornamented with a low crest, which the bird erects or depresses at will, and is of a more reddish coloration than the rest of the back; a broad, black streak passes through the eye and round the back of the head; the quills are blackish, with a white spot on the tips of the primaries, which is yellow on the outer webs; the secondaries dusky grey tipped with white, eight or nine of the innermost having wax-like appendages; primary coverts tipped with white; tail grey, with a broad band of yellow at the tip, before which is a blackish band; the tips of the feathers also with wax-like appendages; throat black, edged with whitish at the base of the lower mandible, and shaded with rufous below; under tail-coverts chestnut. The female is like the male, but has the wax-like appendages to the wing and tail smaller.

THE SIXTH FAMILY OF THE FINCH-LIKE PERCHING BIRDS.—THE HIRUNDINIDÆ. SWALLOWS.

The researches which osteologists have instituted during recent years into the skeletons of birds have resulted, in some instances, in a change of classification, which must seem strange to those who remember the time-honoured arrangements of Cuvier, and it seems at first sight an unacceptable proposition to separate certain groups so far away from one another in the natural systems. Thus it is doing violence to the old classifications to put the Sun-birds in a different order to the Humming-birds, considering the great similarity in their outward form and habits, and the same may be said of the Swallows and the Swifts. Of the grounds of their separation, however, the following explanation by Professor Garrod* is worthy of attentive study:—

“The common Swift and the common Swallow are birds which intimately resemble one another in many respects. The size and general coloration are much the same. In both the beak is very broad and short, the first bone of the pointed wing, which corresponds to the human upper arm bone,† being also particularly short; whilst the bones of the wing which agree with those of the fore-arm—the radius† and the ulna†—are proportionately very long. In both the feet are small, and the power of progression on the ground feeble, each living almost entirely on the wing, making the smaller insects its staple article of food, and each building its nest in walls or eaves of roofs, not in the branches of trees.

“This collection of external resemblances would generally be accepted as sufficient evidence that the Swallow and the Swift are closely allied birds . . . Further, the fact that the two birds are

* See *Zoologist*, Vol. 35, 1877, pp. 217–220.

† See figure of Skeleton of Eagle, Vol. III., p. 241.

described next to one another, or placed side by side in collections, by many of those who are in the habit of employing a systematic method of arranging the different genera, would show that such ornithologists consider the relationship between the Swallow and the Swift to be more intimate than that between either of these birds and the Sparrow, Crow, Starling, Lark, &c. But all these last-named birds are what are known as Passerine; in other words, they possess certain anatomical peculiarities in their organisation, found in them all, and in no other group of birds. If, therefore, the Swift and the Swallow are more nearly related to one another than either is to any other passerine bird, then, as the Swallow is more certainly passerine, the Swift must be so also. But certain naturalists assert that the Swift is not a passerine bird at all, and, if they are correct, it is evident that the Swallow and it cannot have anything to do with one another. Upon this assumption, therefore, the passerine Swallow is much more closely related to the Sparrow, the Crow, and the Lark, than it is to the Swift.

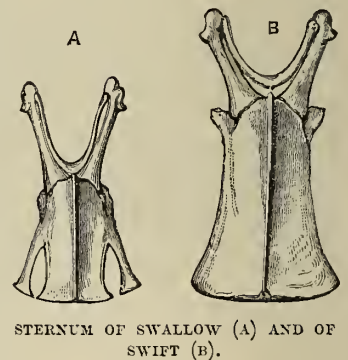
"The question then presents itself—Is it really the case that the importance of the deep-seated anatomical resemblances between the Swallow and the Sparrow, and of the differences between the Swallow and the Swift, is sufficient to justify us, notwithstanding the external similarity between the last-named birds, in believing that the first-mentioned are truly more intimately related the one to the other?

"It may be worth while taking a rapid glance at what some of these important anatomical resemblances and differences happen to be—one of them is the manner in which the feathers are arranged on the skin. Most of us know that, unlike the hair upon a cat or other quadruped, the feathers of a bird are not uniformly distributed over the surface of the body, but grow in linear clusters called *tracts*, with naked intervals, termed *spaces*, between them. This may be readily verified by plucking, say, a Sparrow, and noticing the thick and opaque light-coloured bands formed by the thickening of the skin surrounding the holes, out of which the feathers have been extracted. Between these tracts the skin is seen to be thin and translucent, forming naked spaces through which the colour of the underlying muscles is apparent.

"The careful study, some five and forty years ago, by the eminent German ornithologist, C. A. Nitsch, led him to the conclusion, among others, that these feather-tracts are arranged upon a very different plan in the Swallows to what they are in the Swifts, whilst in the Sparrows and their allies they very closely resemble the Swallows. Further, he showed that in this feature the Swifts and the Humming-birds are almost identical.

Again, the breast-bone, or sternum, in birds is much expanded to give origin to the powerful muscles of flight. In both the Swallow and the Sparrow, as in passerine birds generally, its usually oblong figure is modified by the presence of two deep notches, one on each side of the keel, in the posterior margin. But in the Swift there are no such notches to be found, the posterior margin being entire, and in other respects it differs from the same bone in the Passeres, whilst in all it resembles the Humming-bird. In the Sparrow and the Swallow, again, as in the great majority of the passerine birds, there is, at the lower end of the trachea, or windpipe, where the bronchi which place it in communication with the lungs arise, an elaborate special mechanism, which is known as the muscular organ of voice or lower larynx, by which they have the power—although they do not at all employ it—of modulating their note, so as to produce a song; this is not found in the Swifts. In man, the greater part of the alimentary canal is composed of a tube of small diameter—the small intestine—which is continued onwards as a more capacious one, the large intestine. These two are not simple continuations one of the other, but the former enters the latter obliquely, the nearer end of the large intestine remaining free as the 'blind gut,' or cæcum. In the Swallow and Sparrow, as in all the Passeres, instead of there being a single cæcum at the place of junction of the two intestines, there are two. These are not found in the Swifts nor in the Humming-birds.

"In the Swallow, the Sparrow, and all their true allies, it is always the case that the tendons which contract up the last joints of the toes, are so arranged that the birds have the power of folding



STERNUM OF SWALLOW (A) AND OF SWIFT (B).

the toe which corresponds to our great toe (the one directed backwards), without moving any of the others. In the Swift, however, whenever the great toe (the hallux)* is fully flexed, it is impossible that the other toes should remain opened out, because the two muscles, which act on one and the other, are bound together by a tendinous band.

"In the Swallow, the Sparrow, and most singing birds, the number of feathers in the tail is twelve. In the Swifts and Humming-birds the number is always ten—another important difference. In the Swallow also, as in all the passerine birds, there is a slender muscle running through the thin triangular membrane of the wing, between the arm and the fore-arm, which is quite peculiar in the manner of insertion or attachment, no other birds possessing the same arrangement. In the Swift, this muscle terminates in quite a different manner, here again resembling the Humming-birds exactly.

"Taking these several characters into consideration, and realising how little they are susceptible, on account of their deep-seatedness, to the influence of slight external changes in the mode of life of the species, we are inevitably driven to the conclusion that their weight is overwhelmingly greater than that of the superficial similarity, which is so readily brought about by the similarity of the circumstances under which the two species are accustomed to live, and that the resemblances between them are, so far as their constitutions are concerned, dependent only on the fact that they both have—with different pedigrees—arrived at a superficial similarity in contour, because they subsist exclusively on the same food."

The Swallows, then, may be subdivided into two sub-families, called respectively the Rough-winged Swallows and the Smooth-winged Swallows, both of which sub-families are represented in the Old and New Worlds.

THE FIRST SUB-FAMILY OF THE HIRUNDINIDÆ.—THE ROUGH-WINGED SWALLOWS (*Psolidoprocinæ*).

These birds are called "rough"-winged on account of the serrated edge which is found attached to the outer margin of the first primary. So strongly is this indicated that on pressing the thumb along the edges of the feather a distinct feeling of a saw-like sensation is produced. Curiously enough, this feature only obtains in the males, and as far as has been noted at present, is found in two genera. *Psolidoprocinæ* in Africa, and *Stelgidopteryx*† in the New World. Of the South African Rough-winged Swallow Mr. Layard gives the following brief notice:—"This little Swallow first fell under my notice on the 'Keurboom's River,' Knysna district, where I saw it apparently breeding in holes in the banks, but was unable to investigate its doings more closely. I found it abundantly in the forest, hawking after flies over pools, frequently dipping into the water, and perching on the overhanging boughs in clusters of six or eight, to dry themselves. Their habit of perching is noted by Mr. Cairncross, who writes, 'This bird flies about very much like a bat (this resemblance also occurred to me when I saw it), amongst thick forests, and is generally more visible in rainy, heavy weather; but I have never seen or heard of their breeding here (Swellendam). They remain here after the winter has set in. Sometimes I have seen them roost on trees at the bottom of my garden, where I shot the specimen sent.'"

THE SECOND SUB-FAMILY OF THE HIRUNDINIDÆ.—SMOOTH-WINGED SWALLOWS.

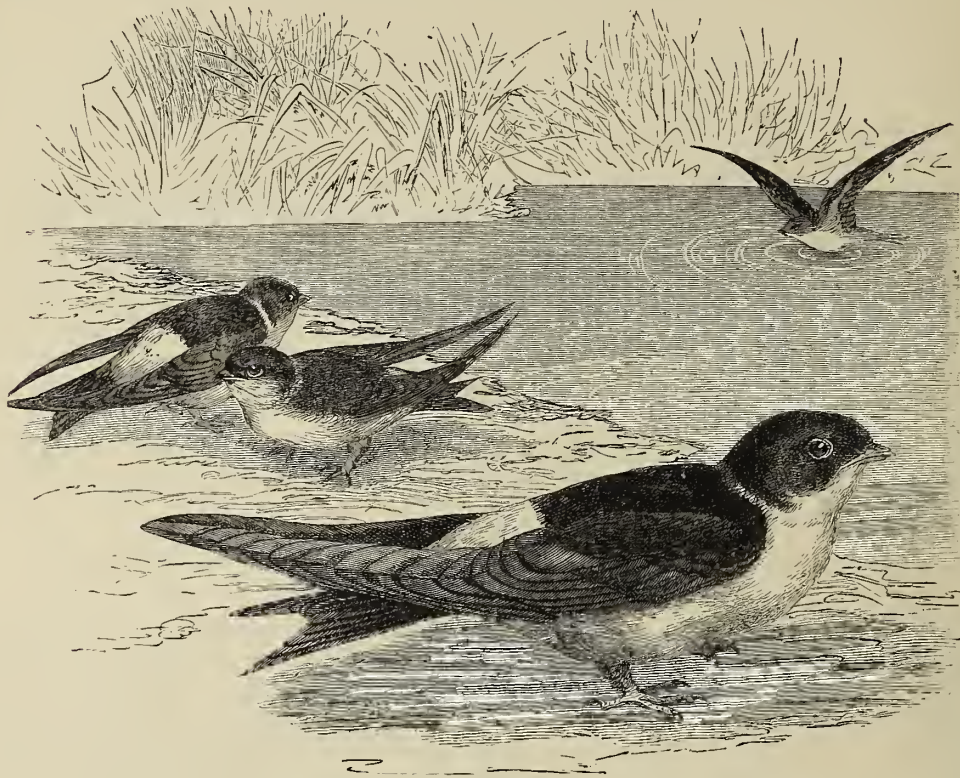
To this group of birds belong by far the larger number of the Swallows, including also the Martins and the Sand Martins. It may not be out of place here to note the points by which the three English species of Swallows may be distinguished by an ordinary observer. On the wing, the Swift is very Swallow-like in appearance, but may be told by its large size, extremely rapid flight, long wings, and entirely black plumage. The Sand Martin breeds in holes of banks, and is the smallest of the three English *Hirundines*, being pale brown above and white below. The common Martin builds a mud nest under eaves of houses or barns, like the Swallow, but may easily be told on the wing by a conspicuous white band across the lower back. The forked tail is not perceptible in the Martin when in flight, but is very easily seen in the common Swallow, especially in the male birds, in which the elongated outer tail feathers are very conspicuous at all seasons of the year. When they first arrive,

* See figure of Skeleton of Eagle, Vol. III., p. 241.

† ψαλίς, a pair of shears; Πρόκη, a mythological character.

‡ στελγίς, a scraper; πτερόν, a wing.

also, the males of the common Swallow have a beautiful rufous blush on the tender parts, which is very apparent and unmistakable as they turn and twist in the sunlight. In the young birds, in their first autumn plumage, the under parts are whiter and they appear smaller.



THE MARTIN.

THE COMMON SWALLOW (*Hirundo rustica*).*

Like the Cuckoo, the arrival of the Swallow is anxiously looked for as a sign of approaching summer, arriving as it does in this country about the middle of April, by a gradual migration, which appears to pass Spain early in February, Malta early in March, Palestine about the middle of that month, and Italy about the 20th of March; it does not arrive in Scotland before the end of April. The same quarters are occupied year after year probably by the identical birds, if their home of the previous year has been undisturbed. Many experiments have been made with a view to ascertain the truth of the latter assertion, and the following anecdote is mentioned by Buffon† :—

In the year 1779, the winter passed without much snow, and the spring was very fine. The Swallows, however, arrived in Burgundy only by the 9th of April, and on the Lake of Geneva by the 14th. It is said that a shoemaker of Basle, having attached to a Swallow's neck a collar on which he wrote

Hirondelle, qui est si belle
Dis-moi, l'hiver où vas-tu ?

received the following spring by the same courier the answer—

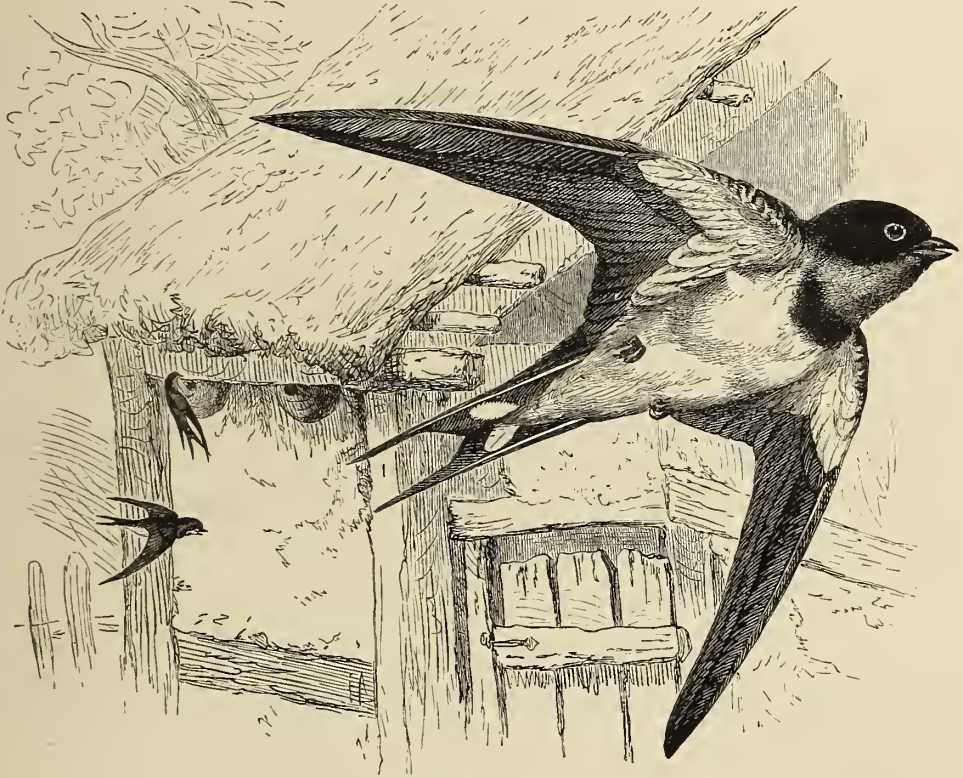
Àthènes, chez Antoine
Pourquoi t'en informes-tu ?

As Buffon himself remarks, the truth of this little anecdote is somewhat dubious; and an English reviewer has also doubted the accuracy of this little story, as well he might, seeing that, as far as we know, the Swallow spends the winter, in which it is absent from Europe, at the Cape of Good Hope, where

* *Hirundo* (Linn.), a proper name; *rustica*, an inhabitant of the country. † "Hist. Nat. Ois. vi.," p. 619.

it is a common bird, and where it is probable it rears a second brood of young ones, as Mr. J. C. Andersson says that in "uncivilised parts of Africa these Swallows affix their nests to some projection of a rock or trunk of a tree, or occupy cavities in rocks or banks."

Throughout Europe generally the Swallow is merely a migrant, arriving as one of the first harbingers of summer, and leaving us before the cold weather sets in. It is now unnecessary to refute the old fable so current among our forefathers that the Swallows hibernate during the winter season, as it has long been satisfactorily proved that such is not the case; but even in the present century it was found necessary to write long essays to prove that they migrate to more genial climes, instead of passing the winter in a state of torpidity in the mud, or in old caves, or hollow trees. Mr. Benzon, of



THE COMMON SWALLOW.

Copenhagen, states that in old prescriptions one sometimes finds reference made to *aqua Hirundinum*, a sort of essence of water and Swallows, which in olden times appears to have been considered a sovereign remedy for many of the ills that man is heir to. Being entirely insectivorous, the Swallow is one of our most harmless and useful birds, and in most parts of Europe it is protected by the peasantry, who object to its being molested, and it would be well if this were everywhere the case. Swift on the wing, and extremely agile and graceful, it glides with the greatest ease through the air, the tail being usually carried but little expanded, and only spread out to its full extent when a sudden turn is made, generally to catch a passing insect.

During fine, clear weather, it is usually seen flying at a great altitude; but in damp, dull weather, it skims close to the ground, following every irregularity in it in search of its insect prey. Their great power of flight enables them to persecute and put to flight most of the birds of prey which may happen to intrude on their domain; and on the appearance of any such intruder, they all collect and join in driving him away, in which they generally succeed. For the nest it usually selects some convenient place under the eaves of a roof or on the beam of an outhouse, or in any shed where

ingress and egress are easy; or it will place its nest down the shaft of an old well, on the face of a rock or quarry, or not unfrequently in a chimney, the last-named place being doubtless selected for the sake of warmth.

Not unfrequently, when the Swallow has carefully finished its nest, it is ousted by some stronger bird, who takes possession, and forces the peaceful Swallow to construct a fresh one. Sparrows are often the intruders; but Mr. Benzou gives two instances which have come under his notice, where the Spotted Flycatcher (*Muscicapa grisola*) has been the aggressor.*

THE SEVENTH FAMILY OF FINCH-LIKE PERCHING BIRDS.

THE TANAGRIDÆ—TANAGERS.

The Tanagers are entirely American, and are described by Dr. Scater, who has studied the family in detail as Dendrostraf Finches, that is, birds which, having all the essential characters of the Finch, are yet so far modified as regards certain parts of their structure as to fit them for feeding, not on grains and seeds, which are the usual food of the true Finches, but on soft fruits and insects, the habitual food of the true Warblers. The Tanagers are mostly birds of very brilliant plumage, and some of the larger kinds are not unlike the Grosbeaks of the Old World. More than three hundred species are known, the greater part of them being non-tropical, though some few kinds inhabit North America during the summer. Some of the most beautiful of the family are contained in the genus *Calliste*, of which nearly sixty species are known to science, but very little has been recorded of their habits. One of the best known, the Lesser Rufous-headed Tanager (*Calliste cayana*), is said to be very common in British and French Guiana, living in the latter country in open spots and in the vicinity of dwellings, and feeding on bananas and other fruits. It is also said to do much harm in the rice-fields.

Of the Brazilian Turquoise Tanager (*Calliste braziliensis*) the late Prince Maximilian of Neuviid states that he met with numbers in several provinces of Eastern Brazil, but less often in the forests than the more open country, which was varied with wood, and particularly at the edges of the plantations. Here it goes commonly in pairs, perching generally upon the top of shrubs, and feeding on fruits. In the month of November the Prince found a nest of this Tanager placed in a thick bush in a fork formed by the separation of four branches, and built after the fashion of that of our Chaffinch (*Fringilla cœlebs*). It was constructed very neatly of wool, nearly all white, only varied with a few watlets and moss and bark interwoven, and lined within with broad threads of bark. The two eggs which it contained were rather long in shape, marbled with pale reddish-violet upon a white ground, and varied with a few irregular black specks and blotches.† One of the best known of the family is

THE SCARLET TANAGER (*Pyrranga rubra*).

An account of the habits of this bird is given in the "History of North American Birds" by Dr. Brewer:—"The Scarlet Tanager is one of the most conspicuous and brilliant of all our summer visitants. Elegant in its attire, retiring and modest in manners, sweet in song, and useful in its destruction of hurtful insects, it well merits a cordial welcome. This Tanager is distributed over a wide extent of territory, from Texas to Maine, and from South Carolina to the northern shores of Lake Huron, in all which localities it breeds. A few are found once in a while as far east as Calais in the spring, and they are rather occasional than common in eastern Massachusetts, but are more plentiful in the western part of the State, becoming quite common about Springfield, arriving May 15th, and remaining about four months, breeding in high open woods and old orchards. In South Carolina it is abundant as a migrant, though a few remain and breed in the higher lands. Mr. Audubon states also that a few breed in the higher portions of Louisiana, and Dr. Heermann found them breeding at El Paso in New Mexico. They are far more abundant, however, in the States of Pennsylvania, New Jersey, Virginia, and throughout the Mississippi valley, arriving early in May and leaving in October. Though occasionally found in the more sparsely-settled portions of

* Dresser: "Birds of Europe."

† Scater: *Mon. Genus C. Iliste*, pp. 62.

the country, in orchards, and retired gardens, they are, as a rule, inhabitants of the edges of forests.

"Their more common notes are simple and brief, resembling, according to Wilson, the sounds *chip-char*. Mr. Ridgway represents them by *chip-a-ra'-ree*. This song it repeats at brief intervals, and in a pensive tone, and with a singular facility of causing it to seem to come from a greater than the real distance. Besides this it also has a more varied and musical chant, resembling the mellow notes of the Baltimore Oriole. The female also utters similar notes when her nest is approached, and in their mating season, as they move together through the branches, they both utter a low whispering warble in a tone of great sweetness and tenderness. As a whole, this bird may be regarded as a musical performer of very respectable merits.

"The food of this species is chiefly gleaned among the upper branches, and consists of various coleopterous and other insects and their larvæ. Later in the season they consume various kinds of wild berries.

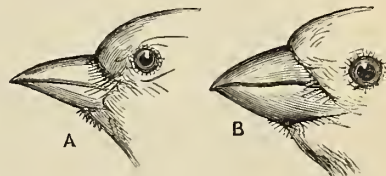
"When their nest is approached, the male bird usually keeps at a cautious distance, as if fearful of being seen, but his much less gaudy mate hovers about the intruder in the greatest distress. Wilson relates quite a touching instance of the devotion of the parent of this species to its young. Having taken a young bird from the nest and carried it to his friend, Mr. Bartram, it was placed in a cage, and suspended near a nest containing young Orioles, in hopes the parents of the latter would feed it, which they did not do. Its cries, however, attracted its own parent, who assiduously attended it, and supplied it with food for several days, became more and more solicitous for its liberation, and constantly uttered cries of entreaty to its offspring to come out of its prison. At last this was more than Mr. Bartram could endure, and he mounted to the cage, took out the prisoner, and restored it to its parent, who accompanied it in its flight to the woods with notes of great exultation.

"Early in August the male begins to moult, and in the course of a few days, dressed in the greenish livery of the female, he is not distinguishable from her or his young family. In this humble garb they leave us, and do not resume their summer plumage until just as they are re-entering our southern borders, where they may be seen in various stages of transformation."

THE EIGHTH FAMILY OF FINCH-LIKE PERCHING-BIRDS.

THE FRINGILLIDÆ—TRUE FINCHES.

The Finches have only nine primary quills, and are divisible into two sections, distinguished by the form of the bill inside. The first section consists of the wide-palate Finches (*Amplipalatales*). In the first section the lower mandible has the cutting edges (*tomium*) of great power, and rising slightly higher on the posterior margin, formed for crushing seeds: the palate is somewhat deeply and broadly arched, with three ridges, rather far apart from one another. The species of this section are mostly characteristic of the Old World, and include among their number all the familiar European Finches and their allies, such as the Bullfinches, Goldfinches, Canaries, Redpolls, Grosbeaks, Chaffinches, and Sparrows. Although a numerous family of birds, the Finches do not offer the great differences in their habits, and a general account of the economy of one of our English species would comprise many of the characteristics of the family generally. It is in the construction of their nests that the Finches greatly differ, this being evidenced by that of the Chaffinch as compared with that of a Bullfinch. The nest of the former is fully described by Macgillivray:—



BILL OF FINCH (A) AND OF HUNTING (B).

"The nest is of moderate size, very neatly constructed, having its exterior composed of moss, lichens, grass, thread, and rags, its interior of wool, feathers, hair, and other suitable materials. Not that all these articles enter into the composition of every nest, for there is great diversity in this respect. When neatly crusted with grey lichens, it is very difficult to distinguish it in the cleft of a

tree, which is the situation usually selected for it; but it is found in a great variety of places, often on tall trees, sometimes in the fork of a shrub, not unfrequently among ivy on a wall, and still more commonly among the twigs of a hawthorn hedge. Gardens, orchards, hedges, groves, copses, and woods are all inhabited by the Chaffinches at this season, but they are very rarely met with in the depth of large woods, especially of those composed of fir. When a person approaches the nest, the birds manifest much anxiety, flying about, or hopping among the twigs, and repeating their



THE CHAFFINCH.

ordinary tweet in a hurried manner. The female sits very close, and from her colour and that of the nest is seldom perceived, but when aware that she has been discovered, she slips off with alacrity, and joins the male in evincing her anxiety as to the result of the intrusion."

The nesting of the Bullfinch is as follows:—About the beginning of May it begins to construct its nest, which is rather loosely formed of small dry twigs, with a lining of fibrous roots, and is placed in a bush, frequently of hawthorn, or on the horizontal branch of a spruce. The eggs, four in number, are of a rather broad oval form, nine and a half twelfths long, seven and a half twelfths in their greatest diameter, of a bluish or purplish white colour, spotted and streaked with purplish-grey and reddish-brown.

The second section contains the Finches with narrow palates (*Arctipalatales*), which have the finch-like character of the lower mandible less strongly pronounced, the palate being narrower,



SISKIN, BULLFINCH, AND GOLDFINCH.

very little arched, having two or three keels placed close together. In this section are found the Crossbills and the Buntings, the latter forming a large group of birds which are especially developed in the New World. The palate in most of the last-named birds is remarkable for a long tubercle, which is very plainly seen in an examination of an ordinary Yellow-hammer or common Bunting. The difference in the form of bill between that of a Bunting and true Finch is well represented in Professor Macgillivray's "British Birds."* To the present



THE WHITE-WINGED CROSSBILL.

section belong the Crossbills, perhaps the most interesting bird of the family as regards its structure. The Crossbills, as a rule, are inhabitants of the northern parts of the Old and New Worlds, though the Himalayas possess one species. The name Crossbill is attached to the bird from the peculiar way in which the mandibles cross each other, giving the bill a very singular appearance. All the species are inhabitants of northern climes, where they frequent conifer forests both in the Old and the New World,† "extracting the seeds of pines and firs from the cones by means of their powerful and curiously-constructed bill, the points of which appear to have received their lateral curvature from the force applied in that direction to separate the scales. The hard, spoon-shaped tongue seems to be the instrument by which the seeds are then taken up. They are gregarious, and wander about in search of their favourite food, appearing at intervals in places not usually frequented by them." With regard to the well-known legend of the Crossbill, the verses of Longfellow on the next page will recur to many readers.

* Plate VIII., Vol. I., Figs. 7, 8.

† Macgillivray: "British Birds" I., p. 414.

THE LEGEND OF THE CROSSBILL.

(From the German of Julius Mosen.)

"On the Cross the dying Saviour
 Heavenward lifts His eyelids calm,
 Feels, but scarcely feels, a trembling
 In His pierced and bleeding palm.
 "And by all the world forsaken,
 Sees He how with zealous care
 At the ruthless nail of iron
 A little bird is striving there.
 "Stained with blood, and never tiring,
 With its beak it doth not cease,

From the Cross 'twould free the Saviour,
 Its Creator's Son release.

"And the Saviour speaks in mildness :
 'Blest be thou of all the good!
 Bear, as token of this moment,
 Marks of blood and holy rood!'

"And that bird is called the crossbill ;
 Covered all with blood so clear,
 In the groves of pine it singeth
 Songs, like legends, strange to hear."

THE NINTH FAMILY OF FINCH-LIKE PERCHING BIRDS.

THE ICTERIDÆ—HANG-NESTS.

The Hang-nests are a strictly American family, showing affinities to the Starlings and Weaver-birds of the Old World. Many of the species congregate in flocks, and affect the ground like the true Starlings, while their long purse-like nests suggest their affinity with the Weaver-birds. There are three sub-families of the *Icteridæ*, viz., the *Agælwineæ*, or Cow-birds, the *Icterinæ*, or true Hang-nests, and the *Quiscalinæ*, or Grakles. In the first of these sub-families are found the Bobolink (*Dolichonyx oryzivorus*), or Rice-bird, and the Cow-birds; the latter being very interesting on account of their parasitic habits, which resemble those of the common Cuckoo of Europe. Dr. Brewer writes of the common Cow-bird (*Molothrus pecoris*):—"This species is at all times gregarious and polygamous, never mating and never exhibiting any signs of either conjugal or parental affections. Like the Cuckoos of Europe, our Cow Blackbird never constructs a nest of her own, and never hatches out or attempts to rear her own offspring, but imposes her eggs upon other birds; and most of these, either unconscious of the imposition or unable to rid themselves of the alien, sit upon and hatch the stranger, and in so doing virtually destroy their own offspring, for the eggs of the Cow-bird are the first hatched, usually two days before the others. The nursing is much larger in size, filling up a large portion of the nest, and is insatiable in its appetite, always clamouring to be fed, and receiving by far the larger share of the food brought to the nest. Its foster companions, either starved or stifled, soon die, and their dead bodies are removed, it is supposed, by their parents. They are never found near the nest, as they would be if the young Cow Blackbird expelled them as does the Cuckoo; indeed, Mr. Nuttall has seen parent birds removing the dead young to a distance from the nest, and there dropping them."* A very instructive article on the "procreant instincts" of the three species of *Molothrus* found in Buenos Ayres has been contributed by that excellent observer, Mr. W. H. Hudson, to the *Proceedings of the Zoological Society* for 1874.

The second sub-family of the *Icteridæ*—viz., the *Icterinæ*—consists principally of the brilliant yellow and black Hang-nests of America, which are popularly called the Orioles of the New World. One of the best known is the Baltimore Oriole (*Icterus baltimore*), a good account of whose habits will be found in the before-mentioned work from the pen of Dr. Brewer. He observes: "The Baltimore Oriole is one of the most common birds nearly throughout New England. Gay and brilliant in plumage, interesting and lively in manners and habits, and a vocalist of rare power, with pathos, beauty, and variety in his notes, this bird has been, and would still be, a great favourite but for his transgressions.

"Among the pea-vines of our gardens he makes his appearance with exemplary punctuality, seeming regardless of the prematurity or tardiness of the season. Rarely does the 10th of May pass without the sound of his welcome notes, and rarely, if ever, does he come sooner. When the male Baltimores first arrive, they come unaccompanied by their mates. At this time their notes are unusually loud, and their voices seem shrill. Their song appears to partake somewhat of the nature of tender

* Baird, Brewer, and Ridgway, "North American Birds," p. 155. This work should be consulted for the history of the true Hang-nests, an interesting account of which is given, but is too long to be reproduced in the present work.

lamentations and complaining. At this period they are very active and restless, moving rapidly through the branches of the trees, just opening into leaf and blossom, searching busily for the insects, which then form their principal food. When, a few days after their arrival, they are joined by the females, the whole character of their song changes, which becomes a lower-toned, richer, and more pleasing refrain. During their love season their resonant and peculiarly mellow whistle resounds in every garden and orchard, along the highways of our villages, and in the parks and public squares of our cities. Nuttall, generally very felicitous in expressing by verbal equivalents the notes of various species of our song birds, describes the notes of its song as running thus: *Tshippe-tschayia-too-too-tshippe—tshippe-too-too*, with several other very similar modifications and variations. But these



THE COW-BIRD.

characters give a very inadequate idea of their song. It must be heard to be appreciated, and no description can do justice to its beauties. The notes are of an almost endless variety, and each individual has its own special variations. The female, too, has her own peculiar and very pretty notes, which she incessantly warbles as she weaves her curiously elaborate nest. To agriculturists this Oriole renders immense service in the destruction of vast numbers of highly injurious insects; among the most noteworthy of these are the common canker-worm and the tent caterpillars, both great pests to orchards. These benefits far more than compensate for its annoying attacks on the pods of esculent peas, the only sin that can rightfully be brought against it, except, perhaps, the acts of theft committed against other birds, in seizing upon and appropriating to it materials collected by smaller birds for their nests. The Baltimore Orioles are devoted, faithful, and courageous parents, resolutely defending their young when in danger, and exposing themselves fearlessly to danger and to death rather than forsake them. If their young are taken and caged the parents follow them, and, if permitted, will continue to feed them."

In the third family of the Hang-nests are the Boat-tails (*Quiscalus*).







CHAPTER VI.

STARLING-LIKE BIRDS AND SONGLESS BIRDS.

THE STURNIFORMES, OR STARLING-LIKE BIRDS—Characters—THE WEAVER BIRDS—Their Extraordinary Nests—Dr. Jerdon's Account of their Habits—Construction of the Nest—Performances of a Tame Baya—THE STARLINGS—Characters—THE COMMON STARLING—Gregarious Habits—THE AFRICAN BEEF-EATER—Their Services to Cattle—THE WOOD SWALLOWS—Mr. Gould's Account of their Habits—THE LARKS—Distinctive Features—Their Habits—Song—THE MESOMYODI, OR SONGLESS BIRDS—Mostly of the New World—Modifications of the Syrinx—THE LYRE BIRDS—THE SPINE-TAILS—THE OVEN BIRD—THE AMERICAN ANT-THRUSHES—THE OLD WORLD ANT-THRUSHES—THE TYRANT BIRDS—THE KINGBIRD—Dr. Brewer's Account of its Habits—THE AMERICAN CHATTERERS—THE COCK OF THE ROCK—THE BELL BIRD—THE UMBRELLA BIRD—THE MANAKINS—THE BROADBILLS—THE PLANT-CUTTERS—ORDER OF PIGEONS—Difference between Pigeons and Game-birds—Features—THE DODOS—Now Extinct—History—THE SOLITAIRE—Also Extinct—THE TOOTH-BILLED PIGEON—THE COLUMBIDÆ, OR TRUE PIGEONS—Four Divisions—THE FOREST PIGEONS—THE TRUE DOVES—THE PASSENGER PIGEON—Its Long-continued Flights—THE BRONZE-WINGS—THE CROWNED PIGEONS.

THE THIRD GROUP OF THE PASSERIFORMES, OR PERCHING-BIRDS.

THE STURNIFORMES, OR STARLING-LIKE BIRDS.

ALL the birds belonging to this series have ten primaries in their wings, the first one being, however, rudimentary, and in some of the Larks so small as to be nearly obsolete, and to require a minute search to discover it at all. Only four families are included in this series, the Weaver Birds, the Wood Swallows, the Starlings, and the Larks. The Weaver Birds and the Larks follow naturally upon the Finches and Buntings, with which birds the previous family of perching birds ended; while the Starlings are not distantly related on the one hand to the American Hang-nests, and on the other hand to the Crows, which they very much resemble in their habit of walking on the ground.

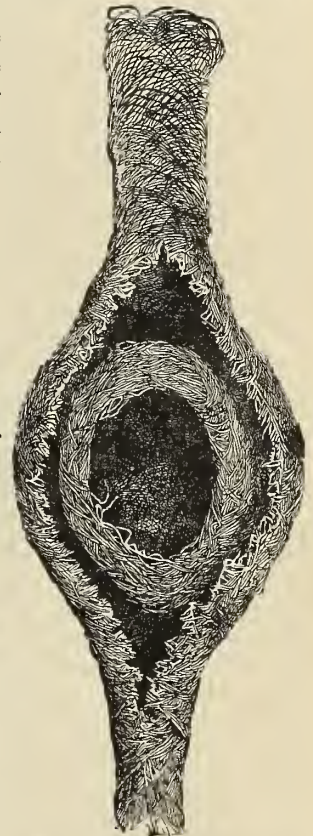
THE FIRST FAMILY OF THE STARLING-LIKE PERCHING-BIRDS.

THE WEAVER BIRDS (*Ploceidæ*).

As already noticed, the Weavers are not very unlike the Finches. They form rather a numerous family distributed over Africa and India, ranging into the Malayan Peninsula. The nests constructed by these birds—the extraordinary character of which structures has gained them their name of Weaver—are among the most interesting productions of bird architecture, as may be seen by any one who visits the nest-room in the British Museum. The following account of the common Weaver Bird of India (*Ploceus baya*) is given by Dr. Jerdon*:—"The common Weaver Bird is found throughout the whole of India, from Cape Comorin and Ceylon to the foot of the Himalayas, and extending into Assam, Burmah, and Malayana. It is most abundant in the well-wooded parts of the country, and in the bare table-land of the Deccan you may travel for days without seeing one. It appears to wander about some localities, for some observers have stated that it is migratory, but it is certainly a permanent resident in most parts of the country; and their roosting places on certain trees are well known. Grain of all kinds, especially rice, and various grass-seeds, form the chief food of the Weaver Bird, and I never observed it feeding on fruit, as Sykes asserts he has known it do on the fig of the banyan tree. Whilst feeding, particularly, as well as at other times, the whole flock keeps up a perpetual chirruping. I have seen it feeding in grain fields in company with flocks of *Emberiza melanocephala*; and Sykes relates that he has seen it associate with the common Sparrow.

"The Baya breeds during the rains, according to the locality, from April to September, but I am

* "Birds of India," Vol. II., p. 244.



SECTION OF NEST OF WEAVER BIRD.

not aware if they ever have more than one brood. Its long retort-shaped nest is familiar to all, and it is indeed a marvel of skill, as elegant in its form as substantial in its structure, and weather-proof against the downpour of a Malabar or Burmese monsoon.

"It is very often suspended from the fronds of some lofty palm-tree, either the palmyra, cocoa-nut, or date, but by no means so universally so as Mr. Blyth would imply, for a babool (*Acacia arabica*, or *Vachellia farnesiana*) or other tree will often be selected, in preference to a palm-tree growing close by, as I have seen within a few miles from Calcutta on the banks of the canal. Very often a tree overhanging a river or tank, or even a large well, is chosen, especially, as Tickell says, if it have spreading branches and scanty foliage. In India I have never seen the Baya suspend its nest except on trees, but in some parts of Burmah, and more particularly in Rangoon, the Bayas usually select the thatch of a bungalow to suspend their nests from, regardless of the inhabitants within. In the cantonment of Rangoon very many bungalows may be seen with twenty, thirty, or more of these long nests hanging from the end of the thatched roof, and in one house in which I was an inmate—that of Dr. Pritchard, garrison surgeon there—a small colony commenced their labours towards the end of April, and, in August, when I revisited that station, there were above one hundred nests attached all round the house! In India, in some localities, they appear to evince a partiality to build in the neighbourhood of villages or dwellings; in other places they nidificate in most retired spots in the jungle, or in a solitary tree in the midst of some large patch of rice cultivation.

"The nest is frequently made of grass of different kinds plucked when green, sometimes of strips of plantain leaf; and not unfrequently of strips from the leaves of the date palm, or cocoa-nut; and I have observed that nests made of this last material are smaller and less bulky than those made with grass, as if the little architects were quite aware that with such strong fibre less amount of material was necessary. The nest varies much in the length both of the upper part or support, and the lower tube or entrance, and the support is generally solid from the point whence it is hung for two or three inches, but varies much both in length and strength. When the structure has advanced to the spot where the birds have determined the egg compartment to be, a strong transverse loop is formed, not in the exact centre, but a little at one side. If then taken from the tree, and reversed, the nest has the appearance of a basket with its handle, but less so in this than in other species, which have seldom any length of support above. Various authors have described this loop or bar as peculiar to the male-nest or sitting-nest, whereas it exists primarily in all, and is simply the point of separation between the real nest and the tubular entrance, and, being used as a perch both by the old birds and the young (when grown sufficiently), requires to be very strong. Up to this time both sexes have worked together indiscriminately, but when this loop is completed, the female takes up her seat upon it, leaving the cock bird to fetch more fibre and work from the outside of the nest, whilst she works on the inside, drawing in fibres pushed through by the male, re-inserting them in their proper place, and smoothing all carefully. Considerable time is spent in completing this part of the nest, the egg chamber being formed on one side of the loop and the tubular entrance at the other; after which there appears to be an interval of rest. It is at this stage of the work, from the formation of the loop to the time that the egg compartment is ready, that the lumps of clay are stuck on, about which there has been so many and conflicting theories. The original notion, derived entirely, I believe, from the natives, was that the clay was used to stick fire-flies on, to light up the apartment at night. Layard suggests that the bird uses it to sharpen his bill on; Burgess that it serves to strengthen the nest. I, of course, quite disbelieve the fire-fly story, and doubt the other two suggestions. From an observation of several nests, the times at which the clay was placed in the nests, and the position occupied, I am inclined to think that it is used to balance the nest correctly, and to prevent its being blown about by the wind. In one nest lately examined there was about three ounces of clay in six different patches. It is generally believed that the unfinished nests are built by the male for his own special behoof, and that the pieces of clay are more commonly found in it than in the complete nest. I did not find this the case at Rangoon, where my opportunities of observing the bird were good, and believe rather that the unfinished nests are either rejected, if built early in the breeding season, or if late, that they are simply the efforts of that constructive faculty which appears, at this season, to have such a powerful effect on this little bird, and which causes some of them to go on building the long tubular entrance long after the hen is seated on her eggs.

‘ I have generally found that the Baya lays only two eggs, which are long, cylindrical, and pure white, but other observers record a larger number. Sundevall states that he found three in one nest. Layard says from two to four; Burgess six to eight; Tickell six to ten. Blyth thinks that four or five is the most usual number. From many observations, I consider two to be the usual number, but have found three occasionally. In those exceptional instances, where six or more eggs have been found, I imagine they must have been the produce of more than one bird. The Baya is stated not to use the same nest for two years consecutively, and this I can quite understand, without having actually observed it.”

The Baya is frequently taken when young, tamed, and taught to pick up rings, or such like articles dropped down a well; or to snatch the ticca-work off the forehead of a person pointed out. It is also taught occasionally to carry a note to a particular place, on a given signal. Mr. Blyth, in an unpublished paper, has the following interesting account of some of this bird's performances:—"The truth is, that the feats performed by trained Bayas are really very wonderful, and must be witnessed to be fully credited. Exhibitors carry them about, we believe, to all parts of the country; and the usual procedure is, when ladies are present, for the bird, on a sign from its master, to take a sweetmeat in its bill, and deposit it between a lady's lips, and repeat this offering to every lady present, the bird following the look and gesture of its master. A miniature cannon is then brought, which the bird loads with coarse grains of powder one by one, or more commonly with small balls of powder made up for the purpose; it next seizes and skilfully uses a small ramrod, and then takes a lighted match from its master, which it applies to the touchhole. All this we have personally witnessed, in common with most persons who have resided in or even visited India; and we have seen the little bird apply the match five or six times successively before the powder ignited, which it finally did with a report loud enough to alarm all the Crows in the neighbourhood, while the little Baya remained perched on the gun, apparently quite elated with its performance." Captain Tytler mentions also "the twirling of a stick with a ball of fire at each end. Thus the bird turns in several ways round its head, making luminous circlets in imitation of a native practice; the stick being held by the beak in the middle!"

It is further asserted that "in an ordinary cage or aviary they will employ themselves constantly, if allowed the chance, in intertwining thread or fibres with the wires of their prison, merely gratifying the constructive propensity, with apparently no further object, unless, indeed, the sexes are watched, when they breed very readily in captivity, of course provided they are allowed sufficient room, as in a spacious aviary."

THE SECOND FAMILY OF THE STARLING-LIKE PERCHING BIRDS.

THE STARLINGS (*Sturnidæ*).

The Starlings are found only in the Old World, where they form a very large and natural group. They are distinguished by having moderate or long wings, with the first primary always short; the nostrils are oblong, covered with a small soft speculum on the upper edge, more or less feathered, but having a naked edge of rather thicker texture; the forehead is depressed and broad, and there are no rictal bristles. In many species the feathers which cover the nostrils fall off when the bird becomes old; the feet are generally of large size, and robust, and their habits are generally gregarious, most of them frequenting the ground, where they assemble in large flocks. There are two sub-families, the *Sturninæ*, or true Starlings, and the *Buphaginæ*, or Beef-eaters.

THE FIRST SUB-FAMILY OF THE STURNIDÆ.—THE TRUE STARLING (*Sturninæ*).

Of this sub-family there are three divisions, the first containing the Starlings proper, of which our own English bird is the type; the second contains the Pastors and Old World Grakles, while in the third division are comprised the Glossy Starlings.

THE COMMON STARLING (*Sturnus vulgaris*).

This is one of the most beautiful of our British birds, and is likewise an inhabitant of the whole of Europe. In Asia Minor and Persia its place is taken by the Purple Starling (*Sturnus purpureus*), while in Siberia a third species takes its place, which extends to the Himalayas. The habits of the English Starling have been so frequently described that a long account of them is not necessary.

Few people can have visited country districts, or even walked in the parks or open spaces of London itself, without having formed an acquaintance with this familiar bird, who builds his nest with impunity in many of the private houses in the suburbs, or in the public buildings of our great cities. In the country they breed in the towers of churches, old buildings, and homesteads, and as soon as the young are reared they frequent the orchards, where they do considerable damage to cherries and other fruits.



THE COMMON STARLING.

This, however, is amply compensated for by the immense amount of good which the Starling does in destroying the larvæ of noxious insects, and large flocks are seen in the autumn and winter busily engaged in this useful occupation, generally in company with their friends the Rooks. Bishop Stanley furnishes the following interesting evidence respecting the gregarious habits of the present species:—"Not far from the church we have mentioned there is a considerable sheet of water, occupying nearly thirty acres, flanked and feathered on the eastern side by the old beech-wood, already spoken of as the abiding place of the Jackdaws. Its western margin is bounded by an artificial dam, which, as the water is upon a much higher level, commands an extensive view over a flat, rich country, the horizon terminated by the faint outline of the first range of Welsh mountains. This dam, on the finer evenings of November, was once the favourite resort of many persons, who found an additional

attraction in watching the gradual assemblage of Starlings. About an hour before sunset little flocks, by twenties or fifties, kept gradually dropping in, their numbers increasing as daylight waned, till one vast flight was formed, amounting to thousands, and at times, we might almost say, to millions. Nothing could be more interesting or beautiful than to witness their graceful evolutions. At first they might be seen advancing high in the air, like a dark cloud, which in an instant, as if by magic, became almost invisible, the whole body, by some mysterious watchword or signal, changing their course, and presenting their wings to view edgeways, instead of exposing, as before, their full expanded spread. Again, in another moment, the cloud might be seen descending in a graceful sweep, so as almost to brush the earth as they glanced along. Then once more they were seen spiring in wide circles on high, till at length, with one simultaneous rush, down they glide with a roaring noise of



THE AFRICAN BEEF-EATER.

wing till the vast mass buries itself unseen, but not unheard, amidst a bed of reeds projecting from the bank, adjacent to the wood, for no sooner were they perched than every throat seemed to open itself, forming one incessant confusion of tongues."

THE SECOND SUB-FAMILY OF THE STURNIDÆ.—THE BEEF-EATERS.

This sub-family of the Starlings is represented by only two species, both peculiar to Africa. They are very unlike the true Starlings, having a very stout and hard bill, which is straight and swollen just behind the tip; the nostrils are bare; the feet are very short and stout, and are furnished with curved claws, which are extremely sharp.

THE AFRICAN BEEF-EATER (*Buphaga africana*).

Although commonly known as the Beef-eater, it must not be supposed that the birds actually feed on the flesh of the animals whose backs they frequent in order to gain a living. More than one traveller, however, has complained of the wounds caused in the backs of the cattle by these birds in their endeavours to extract the grubs from them. Mr. Andersson gives the following note on the habits

of the South African species :—"The arrival of these birds is announced by a sharp cry ; and the next moment they may be seen in a little flock descending fearlessly on and amongst the cattle, which are at first much alarmed, and run about in wild confusion, just as they do when troubled with gadflies ; but these apprehensions are soon dispelled, and exchanged for sensations of evident pleasure, as the oxpeckers run over their backs, sides, and bellies, like Woodpeckers upon trees, except when an ox, by an occasional jerk or sudden twist, appears to indicate that the claws of the bird have caused something like pain by touching some spot where the skin of the animal happens to be tender." The same author also alludes to the bird in his "Lake N'gami :—"It is also a frequent companion of the Rhinoceros, to which, besides being of service in ridding him of many of the insects that infest his hide, it performs the important part of sentinel. On many occasions has this watchful bird prevented me from getting a shot at that beast. The moment it suspects danger it flies almost perpendicularly up into the air, uttering sharp shrill notes that never fail to attract the attention of the Rhinoceros, who, without waiting to ascertain the cause, almost instantly seeks safety in a precipitate flight."

THE THIRD FAMILY OF THE STARLING-LIKE PERCHING BIRDS.

THE WOOD SWALLOWS (*Artamidae*).

The exact relations of the present family have been very variously determined by naturalists, some of whom have placed them near the Shrikes. In the wild state they resemble Swallows in their actions and general mode of life, while in the shape of their bills they exhibit great affinities to some of the Shrikes and Crow-shrikes. The food consists of insects, and the habitat of the Wood Swallows is the Australian region, where they are distributed not only over Australia itself, but all over the Moluccas, and one species is found in the Indian Peninsula and the Burmese countries. Mr. Gould writes of the common Wood Swallow (*Artamus sordidus*):—"The Wood Swallow must, I think, ever be a general favourite with the Australians, not only from its singular and pleasing actions, but from its often taking up its abode and incubating near the houses, particularly such as are surrounded by paddocks and open pasture-lands skirted by large trees. It was in such situations in Tasmania that, at the commencement of spring, I first had an opportunity of observing this species. It was then very numerous on all the cleared estates on the north side of the Derwent, about eight or ten being seen on a single tree, and half as many crowding one against another on the same dead branch, but never in such numbers as to deserve the appellation of flocks. Each bird appeared to act independently of the other ; each, as the desire for food prompted it, sallying forth from the branch to capture a passing insect or to soar round the tree and return again to the same spot. On alighting it repeatedly throws up one of its wings, and obliquely spreads its tail. At other times a few were seen perched on the fence surrounding the paddocks, on which they frequently descended, like Starlings, in search of coleoptera and other insects. The form of the wing of the *Artamus sordidus* at once indicates that the air is its peculiar province ; hence it is, that when engaged in pursuit of the insects which the serenity and warmth of the weather have enticed from their lurking places among the foliage to sport in higher regions, this species displays itself to the greatest advantage. But the greatest peculiarity in the habits of this bird is its manner of hanging together in clusters from the branch of a tree like a swarm of bees. The season of incubation is from September to December. The situation of the nest is much varied. I have seen one placed in a thickly-foliaged bough near the ground, while others were in a naked fork, on the side of the bole of a tree, in a niche formed by a portion of the bark having been separated from the trunk, &c. The nest is rather shallow, of a rounded form, about five inches in diameter, and composed of fine twigs neatly lined with fibrous roots. I observed that the nests found in Tasmania were much larger, more compact, and more neatly formed than those on the continent of Australia. The eggs are generally four in number ; they differ much in the disposition of their markings ; their ground-colour is dull white, spotted and dashed with dark umber brown ; in some a second series of greyish spots appear as if beneath the surface of the shell. Their medium length is eleven lines, and breadth eight lines."

THE FOURTH FAMILY OF THE STARLING-LIKE PERCHING BIRDS.

THE LARKS (*Alaudidae*).

In the formation of the scales of the tarsus the Larks very much resemble some of the songless perching birds, which will be presently described, but it need scarcely be said that this external

resemblance is entirely counterbalanced by the possession of a musical apparatus, for the possession of which, as every one knows, the Larks are so famous. They form, however, a natural conclusion to the section of singing Passeres, leading on to the Ant-Thrushes, and the ground-loving, songless birds of the New World. In the formation of the wing the Larks show certain affinities to the Wagtails and Pipits—that is to say, they have the inner secondaries elongated, so as to be about equal to the primaries in length—and they greatly resemble the latter birds in their habits. About one hundred species of Larks are known, and with the exception of the Horned Larks, which are found in America, the vast bulk of the species are inhabitants of the Old World, a great number of them being found in Africa. The hind claw in the Larks, as was also the case in the Pipits, is of varied form, being generally long and straight, as in the case of the Skylarks, but in some of them it is short and rounded.

The common Skylark (*Alauda arvensis*) is an inhabitant of Europe, extending far eastward to the Himalayas, and even to China, but as the bird proceeds to the eastward, certain modifications in the colour of its plumage are noticed, which are considered sufficient by many naturalists to warrant a belief in several species of Skylark.

“There is perhaps none of our native birds,” says Macgillivray, “that has attracted so much attention as the Skylark, nor any that has been so much celebrated by poets and sentimental writers. It might be a pleasant task to cull from our choicest authors the flowers of poesy which derive their beauty from the gentle influence of this sweet songster of the fields; but I must leave it for those who love to study Nature from books, as I find it more profitable to listen to the cheering notes of the Lark herself, to gaze upon her as she floats flutteringly high up in the blue sky, to watch her descent, and run up to inspect her nest among the green grass, while her beloved young ones are rejoicing at her arrival. Towards the end of autumn the Skylarks congregate in large straggling flocks, generally keeping by themselves, although occasionally mingling with small birds of the Passerine and Bunting families. In open weather they frequent the stubble and ploughed fields, where they pick up the seeds of oats, wheat, barley, polygona, and other plants. Like the *Deglubitores*, and many of the *Cantatores*, they use a large quantity of sand and gravel, consisting chiefly of grains of quartz, to aid the process of digestion. I believe their food during the winter consists almost entirely of seeds, although remains of insects may now and then be found in their gizzards. At this season they employ only their ordinary flight, which bears some resemblance to that of the Fieldfare, being performed by slight undulations, and several consecutive flaps of the wings, with short alternate cessations. They generally hover over a field, or fly about in curves, before they alight, which they do in rather an abrupt manner, but not so rapidly as the Corn and Yellow Buntings. On alighting they disperse, and move about, not by leaps, like most small birds, but by an alternate action of the feet, in a half-gliding, half-startful manner, keeping their legs bent and their breasts consequently close to the ground. When in any degree alarmed, they crouch, draw in their neck, and remain motionless until the object of their apprehension has disappeared. Should a person walk up to a flock, he may get quite close to it before the birds think it necessary to rise; and on such occasions they do not all take flight at once, a few here and there rising in succession. Indeed, unless the ground be all gone over, many will remain and allow their companions to fly off. Their movements while rising are rapid and wavering, so that until they are at some distance it is difficult to shoot them. Owing to their habit of crouching, it is by no means easy to perceive them while on the ground, especially if they are among stubble; and as their motions are quick, they traverse a considerable distance in a short time. When there is snow on the ground, they betake themselves to corn-yards, and search the tops of the stacks for seeds; but in frosty weather, when the ground is clear, they prefer settling on the spaces between or around the stacks. If disturbed and forced to fly off, they do not, like the Buntings, Chaffinches, and Sparrows, with which they then associate, perch on the neighbouring trees or walls, but remove to a distance. During this season, they merely utter a short chirping note as they fly, although occasionally a bright day, even so early as January, will elicit their song.

“In the beginning of March, or earlier if the weather is fine, they separate and pair. At this period the males often fight, chiefly in the air; and now their song commences, to be continued until the middle of the autumn. I have heard Larks in full song on the 13th of February in Fifeshire.

This species is perhaps that which, excepting the Whitethroat and the Blackbird, begins to sing earliest in the morning. On the 12th of March, 1835, while on an excursion along the coast, I was greeted at half-past five, between Portobello and Musselburgh, with the full song of the Lark, followed shortly after by those of the Robin and Blackbird, and the harsh cry of the Partridge. In the island of Harris, about the middle of June, in 1820, when on my way to the summit of a hill to see the sun rise, I heard the Lark at half-past one, and soon after the Snipe and Corn Crake. It ceases, however,



THE SKYLARK.

in the evening much earlier than several of our songsters, especially the Blackbird, Thrush, and Robin. The song of the Skylark is familiar to most persons, even those who in cities have exchanged the love of nature inherent in humanity for the love of gain, fashion, and vicious excitement; but were it not, it would be as difficult for me to describe it as it would be for a musician to imitate it. Sometimes the Lark sings on the ground, perched on a clod, or even crouched among the grass, but generally in commencing its song it starts off, rises perpendicularly or obliquely in the air, with a fluttering motion, and continues it until it has attained its highest elevation, which not unfrequently is such as to render the bird scarcely perceptible. Even then, if the weather be calm, you hear its warble coming faintly on the ear at intervals. It has been alleged that the Lark ascends in a spiral manner, but my observation does not corroborate the statement. In rising, it often passes directly upward, but with the body always horizontal, or nearly so, then moves in a curve, and continues thus

alternately, but without a continued spiral motion. At first the motion of the wings is uniformly fluttering, but afterwards it shoots them out two or three times successively at intervals, and when at its greatest height exhibits this action more remarkably. When it descends, the song is not intermitted, but is continued until it approaches the ground, when it usually darts down headlong, and alights abruptly. Frequently it resumes its song after alighting, and continues it for a short time, but more commonly it stops when it has reached the ground. Often the Lark may be seen hovering over a field, in full song, for a considerable time at a small height. On the 4th of May, 1837, I observed a Lark perched on a half-twist whin branch, where it remained singing a long time. I have often seen it perch on a wall, and several times on a hawthorn bush in a hedge, but it never, I believe, alights on tall trees.

"The song of the Lark is certainly not musical, for its notes are not finely modulated, nor its tones mellow, but it is cheerful and cheering in the highest degree, and protracted beyond all comparison. In a sunny day in April or May, when the grass-fields have begun to resume their verdure, it is pleasant to listen to the merry songster that makes the welkin ring with its sprightly notes; in the sultry month of July still more pleasant is it to hear its matin hymn while the dew is yet on the corn; and in winter, should you chance to hear the well-known voice on high, it reminds you of the bright days that have gone, and fills you with anticipation of those that are to come. No doubt much of the pleasure derived from the Lark's song depends upon association, and to him who finds delight in wandering over the green fields, along the daisied margin of the clear stream that winds in the bottom of the pastoral glen, or upon the ferny brae, where the 'long, yellow broom' and 'blossomed furze unprofitably gay' shoot up amidst the wild thyme, yarrow, and blue-bell, it is pleasant to listen even to the 'skirl' of the Corn Bunting, the see-saw song of the Tit, the creaking cry of the Partridge, or the singular crake of the Land Rail; but independently of circumstances and associations, the song of the Lark imparts an elasticity to the mind, elevates the spirits, and suspends for a time the gnawing of corroding care. The mellow song of the Merle or Mavis is apt to inspire melancholy, especially if heard in a sequestered valley towards the close of the day, and the feelings which it excites have perhaps as much of a depressing as of a soothing tendency; but the carol of the Lark, like the lively fife, excites pure cheerfulness, and might with propriety be prescribed as an antidote for dulness. It is not merely music that we look for in the songs of birds, but variety, and the expression of passions, feelings and wants. Were all our warblers to tune their throats according to rule we should become sickly and sentimental, and fill the valleys with sighs and groans from the mountain tops; but the loud war-whoop of the Eagle, the harsh scream of the Heron, and the croak of the Raven, are antidotes to the bewitching melody of the Blackcap and Nightingale. I have endeavoured to trace a repetition at regular intervals in the strains of the Lark; but its modulations seem to have no rule. In confinement this bird sings every whit as well as when at large; and when rapidly perambulating the square bit of faded turf in its cage, it enacts its part with apparently as much delight as when mounting towards 'heaven's gate.'* These last words of Macgillivray's will remind every reader that the Lark has always been one of the chiefest favourites among poets. The Ettrich Shepherd's fine sympathetic lines and Shelley's noble ode, Wordsworth's address and Southey's sonnet, are only a few witnesses to the fact.

The male Skylark is rather larger than the female, and this difference is apparent in winter, when the flocks are mixed together in the fields, the cock bird being conspicuous to a practised observer by his greater bulk when on the wing.

THE SECOND SECTION OF THE PASSERIFORMES, OR PERCHING BIRDS.

THE MESOMYODI, OR SONGLESS BIRDS.

The birds which compose the Mesomyodian section of the Perching Birds belong almost entirely to the New World, with the exception of the *Pittidae*, or Old World Ant-Thrushes. They are separated from the Acromyodian Perching Birds on account of modifications, which take place in the *syrinx*, "an acromyodian bird being one in which the muscles of the *syrinx* are attached to the extremities of the bronchial semi-rings, a mesomyodian bird being one in which the muscles of the *syrinx* join the semi-rings in their middles."†

* Macgillivray: "British Birds," Vol. II., p. 166.

† Garrod: *Proceedings of the Zoological Society*, 1876, p. 507.



THE LYRE BIRD.

THE FIRST FAMILY OF THE MESOMYODI, OR SONGLESS BIRDS.

THE LYRE BIRDS (*Menuridae*).

These curious and interesting birds are found only in Australia, of which they are one of the most characteristic birds. On the habits of the Prince Albert's Lyre-bird (*Menura alberti*) an excellent account is given in Mr. Gould's "Handbook to the Birds of Australia," from the pen of Mr. A. A. Leycester, portions of which are here transcribed:—"The habits of *Menura alberti* are very similar to *M. superba*. Having seen and watched both on their play-grounds, I find the *M. alberti* is far superior in its powers of mocking and imitating the cries and songs of others of the feathered race to the *M. superba*; its own peculiar song or cry is also different, being of a much louder and fuller tone. I once listened to one of these birds that had taken up its quarters within two hundred yards of a sawyer's hut, and he had made himself perfect with all the noises of the sawyer's homestead, the crowing of the cocks, the cackling of the hens, and the barking and the howling of the dogs, and even the painful screeching or the sharpening and filing of the saws. I have never seen more than a pair together. Each bird appears to have its own walk or boundary, and never to infringe on the others' grounds; for I have heard them day after day in the same place, and seldom nearer than a quarter of a mile to each other. Whilst singing, they spread their tails over their heads like a Peacock, and droop their wings to the ground, and at the same time scratch and peck up the earth. They sing mornings and evenings, and more so in winter than at any other time. The young cocks do not sing until they get their full tails, which I fancy is not until the fourth year, having shot them in four different stages; the two centre curved feathers are the last to make their appearance. They live entirely upon small insects, principally beetles. Their flesh is not eatable, being dark, dry, and tough, and quite unlike that of other birds. They commence building their nests in May, lay in June, and have young in July. They generally place their nests on the side of some steep rock, where there is sufficient room to form a lodgment, so that no animals or vermin can approach. The nest is constructed of small sticks, interwoven with moss and fibres of roots, the inside being lined with the skeleton leaf of the parasitical tree fern, resembling horsehair; and covered in, with the entrance on the side. The single egg laid is of a very dark colour, appearing as if it had been blotched over with ink. The young bird for the first month is covered with down, and remains in the nest about six weeks before it takes its departure."

THE SECOND FAMILY OF THE MESOMYODI, OR SONGLESS BIRDS.

THE BUSH-WRENS (*Pterotochidae*).

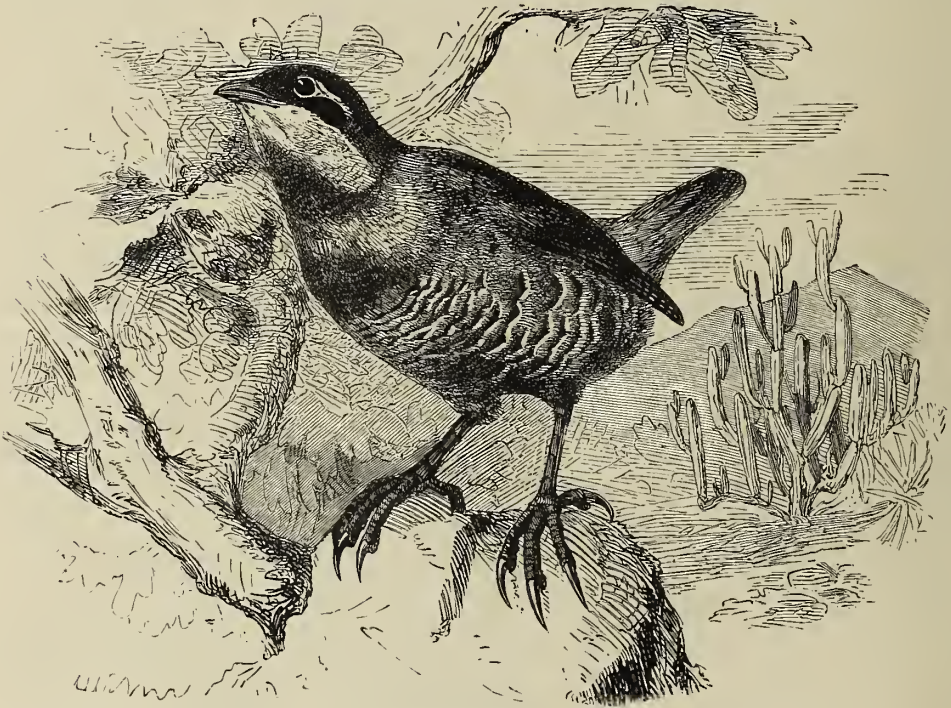
This is a small family of birds belonging to South America, and numbering about eight genera and about seventeen species. They are remarkable for their enormous feet, with very distinctly scaled tarsi. Mr. Darwin writes of *Pterotochus rubecula* in the voyage of the *Beagle*:—"In Chiloe, where it is common, it is called by the Indian inhabitants the 'Cheucau.' It frequents the most gloomy and retired spots within the damp forests. Sometimes, although the cry of the Cheucau is heard close by, a person may watch attentively and yet in vain; at other times, if he stands motionless, the red-breasted little bird will approach within a few feet in the most familiar manner. It then busily hops about the entangled mass of rotting canes and branches, with its little tail cocked upwards. I opened the gizzard of several specimens; it was very muscular, and contained hard seeds, buds of plants, occasionally some insects and vegetable fibres mixed with small stones. The Cheucau is held in superstitious fear by the Chilotans, on account of its strange and varied cries. There are three very distinct kinds—one is called 'chiduco,' and is an omen of good; another 'huitrew,' which is extremely unfavourable; and a third which I have forgotten. These words are given in imitation of its cries, and the natives are in some things absolutely governed by them. I was informed by the inhabitants that the Cheucau builds its nests amongst sticks close to the ground."

THE THIRD FAMILY OF THE MESOMYODI, OR SONGLESS BIRDS.

THE SPINE-TAILS (*Dendrocolaptidae*).

These birds resemble very much in appearance the Old World Tree Creepers, the majority of them having, as their name implies, spiny tails like the birds alluded to. They also climb trees after the manner of Creepers. The family is entirely Neotropical, and contains some two hundred and

twenty species comprised in about forty genera. Considerable variation exists in the form of these birds, some of which, as in the genus *Xiphocolaptes*, attain the dimensions of a good-sized Woodpecker, while some are very minute. The family is divided by Messrs. Scater and Salvin into four sub-families, viz., the *Furnariinae*, or Oven Birds, the *Sclerurinae*, containing but one genus, *Sclerurus*, the *Synallaxinae*, or Spine-tails, and the *Dendrocolaptinae*, or Woodhewers. Mr. Edward Bartlett, who travelled for some time in the upper districts of the Amazon river, met with two species of *Furnarius*, or Oven Bird. Of the *Furnarius torridus*, he says :—"This bird builds its nest in the banks near the water, like the Swallow or Kingfisher ; it is composed of fine sticks and bents very loosely put together. The eggs are four in number and of a creamy white colour, oblong in shape." Of the smaller Oven Bird, the same author relates :—"This interesting little fellow, very different in habits from the preceding species, builds its nest of mud on the bough of a tree. The nest is round,



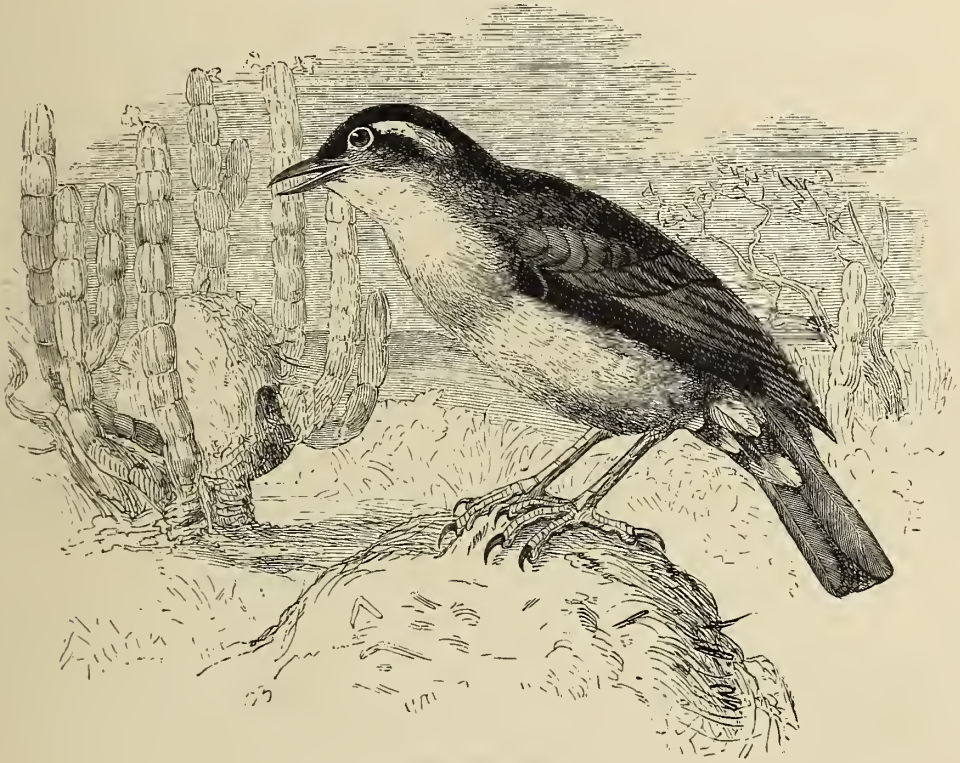
THE BUSH-WREN.

and consists of an inner chamber, the entrance to which is by a passage formed on one side. The chamber is lined with fine long grass fibres, hairs, &c. The eggs are white, and four in number." Writing of the Rufous Oven Bird, Mr. Darwin observes :—"This bird is common in Banda Oriental, on the banks of the Plata ; but I did not see it farther southward. It is called by the Spaniards Casaro, or House-builder, from the very singular nest which it constructs. The most exposed situation, as on the top of a post, the stem of an opuntia, or bare rock, is chosen. The nest consists of mud and bits of straw ; it is very strong, and the sides are thick. In shape it resembles a depressed beehive or oven, and hence the name of the genus. Directly in front of the mouth of the nest, which is large and arched, there is a partition, which reaches nearly to the roof, thus forming a passage or ante-chamber to the true nest. At Maldonado, in the end of May, the bird was busy in building. The *Furnarius* is very common in Banda Oriental ; it often haunts the bushes in the neighbourhood of houses. It is an active bird, and both walks and runs quickly, and generally by starts. It feeds chiefly on coleoptera. It often utters a peculiar, loud, shrill, and quickly reiterated cry."*

Mr. Darwin, in the same work, also describes the habits of another species, *Furnarius cunicularius*.

* Darwin : "Voyage of the *Beagle*" (Birds).

larius, whose habits of nesting, however, are very different. He says:—"It builds its nest at the bottom of a narrow cylindrical hole, which is said to extend horizontally to nearly six feet under ground. Several of the country people told me that when boys, they had attempted to dig out the nest, but had scarcely ever succeeded in getting to the end. The bird chooses any low bank of firm sandy soil by the side of a road or stream. At the settlement of Bahia Blanca the walls are built of hardened mud; and I noticed one, enclosing a court-yard where I lodged, which was penetrated by round holes in a score of places. On asking the owner the cause of this, he bitterly complained of the little *Casarita*, several of which I afterwards observed at work." Mr. Bartlett found two species of *Sclerurus* in the Upper Amazon, and states that these birds are always found in dense forests on the ground, hunting for insects. The Spine-tails are described by M. D'Orbigny as being insect-eating birds of lively



THE OVEN BIRD.

habits, many of them being very tame, and he mentions how one species, the *Synallaxis troglodytoides* (the Wren-like Spine-tail), visited maritime plants when he was in the neighbourhood of Bahia de San Blas, in Patagonia. Each individual rested hardly two minutes in the same place, being always in motion, running over each branch in turn, ascending and descending incessantly, showing no fear. The whole troop flew off at once and settled again at a little distance off, but on a shot being fired, they all disappeared. The same writer also states that some of the Spine-tails live more in the thickets, and frequent the bushes and big plants, sometimes rather near the water, at others in more arid localities. Many of them are found in the cold regions, as well as the temperate and hot portions of the American continent. Of the Woodhewers, which are larger birds, but little has been recorded as regards their habits. Mr. Salvin states that the Northern Woodhewer (*Xiphocolaptes emigrans*) was seen by him in Guatemala. On each occasion the bird was observed on the trunks of the larger trees, to which it clings just like a Woodpecker, and ascends rapidly to the summit. When pursued, it takes short flights, of about one hundred yards or so to another tree, alighting on it near its base, and again ascending to the top of its stem, whence another flight is taken.

THE FOURTH FAMILY OF THE MESOMYODI, OR SONGLESS BIRDS.

THE AMERICAN ANT-THRUSHES (*Formicariidae*).

As in the case of so many other Mesomyodian birds, the *Formicariidae* are entirely inhabitants of the New World. About two hundred and twenty species are known to science, and these are arranged in two sub-families, the first of which, the *Thamnophilinae*, contains the birds which are popularly known as American Bush Shrikes. These have an aspect very similar to the Bush-Shrikes (*Dryoscopus*) of Africa, while in their habits they also resemble the Butcher-birds of the Old World. M. D'Orbigny writes:—"They are, in America, the representatives of our Shrikes, with this important difference in their habits, that instead of invariably perching on bushes, they are found always in the interior, and rarely appear outside. They are bush-birds *par excellence*, all living to the east of the Andes; at least we do not know of any which has been brought from the west of that great chain. They live in all the localities where dense thickets are to be found, either in the hedges near houses or in the deserted clearings in the heart of the forest, or else in the stunted thickets, bristling with thorns, which are called chaparrales by the Spaniards, and which are characteristic of certain parts of Central South America. They go as a rule either alone or in couples, and the most familiar of them approach inhabited places, springing from branch to branch at the bottom of the bushes, which they scour in search of insects and their larvæ, and ants. They very rarely descend to the earth, and then only for the purpose of seizing their prey, which they afterwards proceed to devour on the lowest branches of the thicket. They appeared to us resident in the countries of which they were natives, but always going from one place to another. What traveller in the heart of these wild situations so common in America has not been struck, especially in spring-time, by the vociferous songs of the Bush Shrikes, and with the noisy gamut that the males give out, especially at the season of love? Their whole frame trembles with happiness; their crest raises itself; they open their wings, and show every sign of pleasure, whilst the female hastens to reply to their transports, but in accents less pronounced. These conversations often strike the ear, but one may search in vain for the performer, the birds being almost always hidden in thickets so dense that the rays of the sun scarcely penetrate them. It is in such places as these that they even deposit their nest at some feet above the ground. It is made of twigs outside, and sometimes lined with hair inside. Their eggs very much resemble those of our Shrikes, in that they are often whitish, spotted with reddish-violet."

THE FIFTH FAMILY OF THE MESOMYODI, OR SONGLESS BIRDS.

THE OLD WORLD ANT-THRUSHES (*Pittidae*).

The members of this family, which represent in the Old World the Ant-Thrushes mentioned in the preceding family, are, unlike the latter, birds of very striking and brilliant plumage. From Australia, throughout the Molucca Islands, they range through the Malayan Peninsula and Burmese countries into China, several species inhabiting the Himalayan Mountains, while one is common to the Indian peninsula and in Ceylon. The genus then disappears from the intervening countries, but is once more represented by the Angola Pitta (*Pitta angolensis*) in West Africa; this species, however, appears merely to inhabit the coast line. Most of the Pittas appear to be migratory. They nest on the ground, or on low branches close to the ground. Of the habits of the Blue-winged Pitta an excellent account has appeared from the pen of Mr. W. Davidson:—"For many months after my arrival in Burmah I did not meet with this species; but while at Tavoy, towards the latter end of April, after a few good showers of rain, they suddenly appeared in great numbers in the gardens and plantations in and about Tavoy. Before the rain, I can safely affirm that there were none about the place, for day after day for the greater part of the month had I been working the country in which they subsequently became so numerous. From this time till I left Burmah, in July, they were numerous everywhere. Subsequently I have, year by year, noticed the annual emigration throughout the southern and central portions of the province. Very likely they extend to the north, but I have never been there at the right season. I suspect, however, that they are rather a coast-loving species. Although the great mass of the birds come as described, a few, I think, remain all the year round in the mangrove swamps of the southern extremity of the province; at any rate, I have found them there from January to July. This species is very fond of perching

* "Stray Feathers," 1878.

on trees ; you may continually see them high up upon trees calling vociferously. They are not at all wild or shy birds ; they feed freely on ants and their larvæ, all insects, grubs, and land shells. I never noticed this or any of its congeners coming to the water to drink. This, and the closely-allied *P. megarhyncha*, seem to frequent most commonly their tree jungle, where there is not much underwood, and the mangrove swamps, but they also occur abundantly in gardens and plantations. They both have a fine clear double note, which may constantly be heard in the morning and evening wherever they occur. They are decidedly noisy, and often call all day, and, on moonlight nights, a great part of the night also."

THE SIXTH FAMILY OF THE MESOMYODI, OR SONGLESS PERCHING-BIRDS.

THE TYRANT BIRDS (*Tyrannidae*).

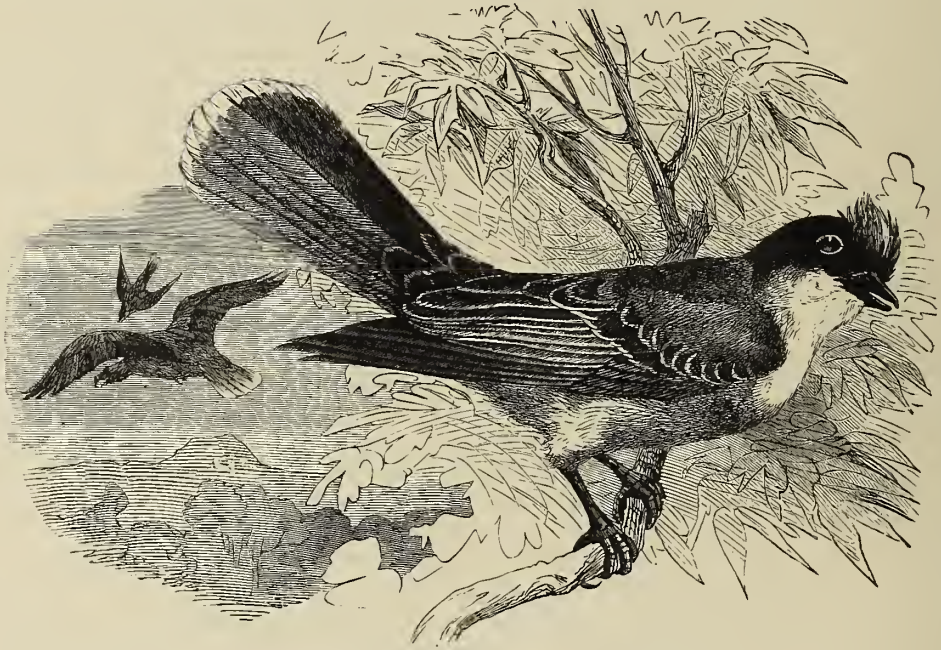
This family is one of the most characteristic of the many which are peculiar to the New World. In the flattened bill, and the great development of the rictal bristles, they bear great resemblance to the Flycatchers of the Old World, but the structural peculiarities of their tarsus, which has the scales arranged in a different manner, in addition to the different formation of the voice-organ, sufficiently serves for the separation of the families *Tyrannidae* and *Muscicapidae*. More than three hundred species are now known to science, not thirty of which are found within the limits of the United States, so that the vast bulk of the Tyrant-birds are peculiar to Southern and Central America.

THE KINGBIRD (*Tyrannus carolinensis*).

This is one of the North American species of Tyrants ranging over a wide expanse of country, and visiting Central America in winter. The following account of the species is given in the "History of North American Birds," by Dr. Brewer :—"No one of our common birds possesses more strongly-marked characteristics of manners and habits than this species. Its pugnacious disposition during the breeding season, the audacious boldness with which it will attack any birds larger than itself, the persistent tenacity with which it will continue these attacks, and the reckless courage with which it will maintain its unequal warfare, are well-known peculiarities of this interesting and familiar species. Its name, Kingbird, is given it on the supposition that it is superior to all other birds in these contests. My own observations lead me to the conclusion that writers have somewhat exaggerated the quarrelsome disposition of this bird. I have never, or very rarely, known it to molest or attack any other birds than those which its own instinct prompts it to drive away in self-defence, such as Hawks, Owls, Eagles, Crows, Jays, Cuckoos, and Grakles. These it will always attack and drive off quite a distance from their nests. Nothing can be more striking than the intrepidity with which one of these birds will pounce upon and harass birds vastly larger and more powerful than itself. The Kingbird is always prompt to perceive the approach of one of these enemies, and always rushes out to meet it ; mounting in the air high above it, it pounces down upon its back, upon which it will even rest, furiously pecking at the exposed flanks of its victim, and only leaving it to descend again and again with the same unrelenting animosity. In these encounters it always comes off conqueror. Wilson states that his jealous affection for his mate, and for his nest and young, makes him suspicious of every bird that happens to pass near his residence. But this is not the case in all instances. A pair of these birds nested in the summer of 1871, and peacefully reared their young in an apple-tree near my residence, within four feet of the nest of the Baltimore Oriole, and not more than eight or ten feet from the nest of a Robin, all in the same tree. The three pairs were on evident terms of amity and mutual good-will. The male Kingbird kept a sharp look-out for danger from the topmost bough, and seemed to have all under his special guardianship, but showed no disposition to molest or annoy them.

"The Purple Martin is said to be the implacable enemy of the Kingbird, and one of the few birds with which the latter maintains an unequal contest. Its superiority in flight gives the former great advantages, while its equal courage and strength render it more than a match. Audubon relates an instance in which the Kingbird was slain in one of these struggles. Wilson also relates an encounter, of which he was an eye-witness, between one of this species and a Red-headed Woodpecker, in which the latter, while clinging on the rail of a fence, seemed to amuse itself with the violence of the King-

bird, playing bo-peep with it round the rail, while the latter became greatly irritated, and made repeated, but vain attempts, to strike at him. The Kingbird feeds almost exclusively upon winged insects, and consumes a vast number. It is on this account one of our most useful birds, but unfortunately for its popularity it is no respecter of kinds, and destroys large numbers of bees. In districts where hives of honey-bees abound the Kingbird is not in good repute. Wilson suggests that they only destroy the drones, and rarely if ever meddle with the working bees. But this discrimination, if even real, is not appreciated by the raisers of bees, who regard this bird as their enemy. The Kingbirds arrive in Pennsylvania the latter part of April, and in New England early in May, and leave for the south in September. They nest in May, selecting an upper branch, usually of an isolated tree, and often in an exposed situation. Their nests are large, broad, and comparatively shallow, and coarsely, though strongly, made of rude materials, such as



THE KINGBIRD.

twigs, withered plants, bits of rags, string, &c. These are lined with fine rootlets, horsehair, and fine grasses.

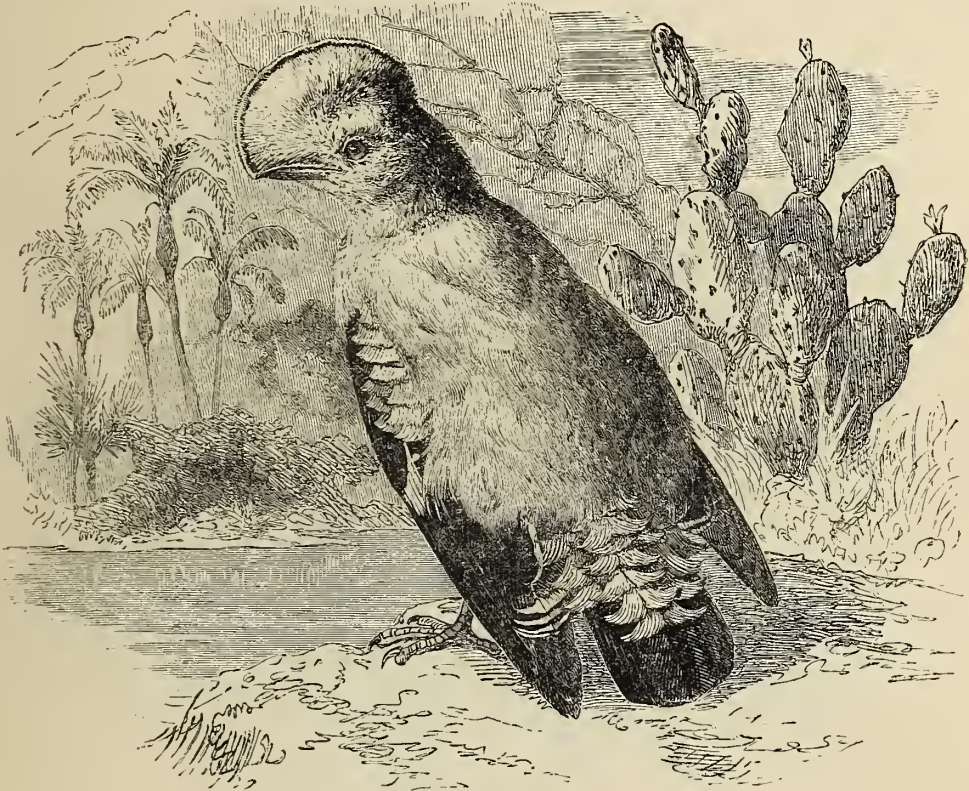
"The Kingbird has no song, but instead utters an incessant monotonous succession of twitterings, which vary in sharpness and loudness with the emotions that prompt them. The flight of the Kingbird, when on the hunt for insects, is very peculiar and characteristic. It flies slowly over the field with rapid vibrations of the wings in the manner of Hawks, and soars or seems to float in the air in the manner of a Swallow. It also exhibits great power and rapidity of flight when rushing forth to encounter a Hawk or an Eagle. As they are known occasionally to plunge into the water, and, emerging thence to resume their seat on a high branch, to dry and dress their plumage, it has been conjectured that they feed on small fish, but this is unsupported by any positive evidence. Though the Kingbird usually builds in trees, it does not always select such situations. In the summer of 1851, passing over a bridge near the village of Aylesford, in Nova Scotia, I observed a Kingbird fly from a nest built on the projecting end of one of the planks of which the bridge was made. So remarkably exposed a position, open to view and on a level with and within a few feet of a highway, must be quite unusual. The eggs of this bird are five, sometimes six, in number, and vary considerably in size. Their ground colour is white with a more or less decided roseate tinge, beautifully spotted with blotches and markings of purple, brown, and red-

brown. In some these are disposed in a confluent crown around the larger end ; in others they are irregularly distributed over the entire egg. In length they vary from 1·05 to ·86 of an inch, and in breadth from ·72 to ·70 of an inch."

THE SEVENTH FAMILY OF THE MESOMYODI, OR SONGLESS BIRDS.

THE AMERICAN CHATTERERS (*Cotingidae*).

To this family belong nearly a hundred species of birds, mostly of gay plumage, which are found in the New World. Some of the most interesting are the brilliantly coloured Cotingas, or Chatterers



THE COCK OF THE ROCK.

of South America, in which the plumage is of a mingled blue and crimson ; but there are also in this family equally familiar birds, such as the Cocks of the Rock, the Umbrella-birds, and the Bell-birds. The habits of the common Bell-bird are described by Mr. Waterton in his "Wanderings." Speaking of the several Cotingas of the country under notice, he says :—"The fifth species is the celebrated 'Campanero' of the Spaniards, called 'Dara' by the Indians, and 'Bell-bird' by the English. He is about the size of the Jay. His plumage is white as snow. On his forehead rises a spiral tube nearly three inches long. It is jet-black, dotted all over with small white feathers. It has a communication with the palate, and when filled with air it looks like a spire ; when empty it becomes pendulous. His note is loud and clear, like the sound of a bell, and may be heard at the distance of three miles. In the midst of these extensive wilds, generally on the dried top of an ancient wood, almost out of your reach, you will see the Campanero. No sound or song from any of the winged inhabitants of the forest, not even the clearly pronounced 'Whip-poor-will' from the Goatsucker, causes such astonishment as the toll of the Campanero. With many of the feathered race he pays the common tribute of a morning and evening song ; and even when the meridian sun has shut in silence

the mouths of almost the whole of animated nature, the Campanero still cheers the forest. You may hear his toll and then pause for a minute, then another toll and then a pause again, and then a toll and again a pause; then he is silent for six or eight minutes and then another toll, and so on. Acteon would stop in mid-chase, Maria would defer her evening song, and Orpheus himself would drop his lute to listen to him, so sweet, so novel, and so romantic is the toll of the pretty snow-white Campanero. He is never seen to feed with the other Cotingas, nor is it known in what part of Guiana he makes his nest."

With regard to the spiral tube on the forehead, or caruncle, Mr. Salvin remarks* :—"From dried specimens it is impossible to make any satisfactory dissection of the caruncles, to ascertain whether or not any communication exists through means of which air could be passed so as to inflate them and



THE UMBRELLA BIRD.

cause them to become rigid. On opening the caruncle of an immature male, I found that fine fibrous tissues adhered to the enclosing skin. This would show that in life the caruncle is not hollow, and that, if the internal structure is cellular and capable of inflation by air, these tissues would prevent the outer skin from swelling and taking a bladder-like form. If inflation actually is produced, as analogy with the Cayenne-bird, as described by Mr. Waterton, would certainly suggest, it still remains to be seen from what source the air pressure is derived. The question, too, arises, Is the inflating apparatus, if I may so call it, the growth of the maturing male, as are the caruncles themselves? My own impression is that no inflation takes place, and that the bird possesses little or no voluntary muscular control over these excrescences, but that contraction or elongation takes place, as in the fleshy protuberance over the bill of the common Turkey. The same appears to be the case with the several members of the genus *Cephalopterus* (Umbrella-birds), one species of which is said to gather its throat-lappet under its throat in a bunch like a rose. A muscular contraction would cause one of these caruncles to become more rigid, as in the familiar case above cited."

* "Ibis," 1865, p. 93.

THE EIGHTH FAMILY OF THE MESOMYODI, OR SONGLESS BIRDS.

THE MANAKINS (*Pipridæ*).

The Manakins are closely allied to the Tyrants, and form a small family of American birds, consisting of about sixty species. All the Manakins are of small size, and inhabit the wooded portions of South America, and they are somewhat shy in their habits. Of the latter, however, very little has been recorded.

THE NINTH FAMILY OF THE MESOMYODI, OR SONGLESS BIRDS.

THE BROADBILLS (*Eurylemiidæ*).

In appearance the Broadbills most resemble some of the broad-billed Rollers (*Eurystomus*) with which they have been commonly classed by naturalists, but of late years more minute study of



THE BROADBILL.

their anatomy and general structure has resulted in placing them near the Chatterers of America, of which they appear to be a representative form in the Far East. The species are only about seven in number, all of them being confined to the Himalayan Mountains, the hills of the Burmese countries, the Malayan peninsula, and the Indo-Malayan islands. Writing of these birds in Tenasserim, Mr. Davison says:—"The Broadbills, I think, might well be designated a stupid set of birds, but the Lunated Broadbill (*Serilophus lunatus*) is the most stupid of the lot. They usually move about in small parties, and when one meets with a party every bird of which it consists can without difficulty be secured, as the birds take no notice of their companions being shot, and do not appear to be at all alarmed at the report of the gun, seldom moving farther than the next branch, sometimes not moving at all, when the gun is fired. Their note consists of a single chir-r-r. They never walk or hop about the branches, though they will fly from branch to branch. They feed chiefly on insects, many of which they seize on the wing."* The same author writes of the Sumatran

* "Stray Feathers," 1878, p. 89.

Broadbill (*Corydon sumatranus*):—"This species is spread throughout Tenasserim, but is nowhere abundant, being found in pairs or small parties, usually in moderately thin forest, but it occurs also in dense forest. During the day it is sluggish, and a party will, like *S. lunatus*, allow themselves to be shot one after the other without any attempt to escape.

"They have an oft-repeated, mellow, rather musical note, quite different from, and not at all of the same class as that of the preceding species, and also a clear whistle, which they utter when flying from tree to tree. It does not ascend the higher hills, nor indeed do any of the preceding species. Not only is their note entirely different, but they are far more sluggish than the rest of the Broadbills, feeding almost exclusively morning and evening, and sitting for hours motionless on a branch, sometimes high up and sometimes low down, in a slouching attitude, with their necks drawn in and their bills pointing upwards. They are not at all shy, and by no means curious about what is passing around them; but one day, when I was waiting by a clear pool, watching for *Alcedo nigricans*, one came and sat on a branch about ten feet distant. He clearly thought me a very strange animal, for though he did not attempt to go away, he kept craning out his neck, and peering down at me in a stupid inquisitive fashion. Thus we remained for about two hours, when a Kingfisher not appearing, I shot my stupid neighbour."

THE TENTH FAMILY OF THE MESOMYODI, OR SONGLESS BIRDS.

THE PLANT-CUTTERS (*Phytotomidae*).

Only three species of Plant-cutter are known, one inhabiting Chili, a second the Argentine Republic, and a third Bolivia. In appearance they resemble a Finch or Tanager, and have been placed by many authors in the vicinity of the last-named birds. D'Orbigny writes:—"This singular genus, well characterised by the numerous teeth in the cutting edges of the mandibles and of the interior of the upper mandible, has, moreover, like the Tanagers of the genus *Saltator*, a strong tooth near the extremity of the bill; the wings are short; the tail rather long and equal." The same writer thinks that the Plant-cutters should not be moved far from the Tanagers in the natural system, as they resemble the latter birds a good deal in the form of the bill. In habits the Plant-cutters are still more like the latter birds, for not only do they live in the bushes and on the shrubs, where they feed on fruits, berries, and buds, like the *Saltators*, but they are constantly found in society with them.



THE PLANT-CUTTER.

Speaking of the Narrow-billed Plant-cutter (*Phytotoma angustirostris*), the same author observes :—“It was seen in several localities in the Andes of Bolivia, always in the temperate zone, in dry and arid situations on the *coteaux* and the plains, without ever descending into the hot valleys, which are wooded and moist. One might say that the temperature which it prefers is that where wheat can be grown, and it was never observed by us either above or below this limit. It is always met with in the neighbourhood of habitations and cultivation, and is very common; it is seen throughout the year either singly, in pairs, or in small troops. When mingled with the *Saltators* it traverses the bushes, the gardens of the towns, devastating the plantations, where it cuts off the buds, and spoiling the fruits, doing this without any danger, as up to the present time the people are content with complaining of this inconvenient parasite without seeking any means to stop its ravages. Its flight is short and low, and never long sustained; its habits resemble those of the *Saltators*, but we have nevertheless observed it on the ground. Its cry, which is often repeated, could not be much more disagreeable, as it resembles the noise made by the grating of the teeth of one saw against those of another. At certain seasons the Plant-cutter is very fond of the fruit of a species of *Solanum*, which imparts to the beak a violet colour.”

THE FOURTH ORDER OF BIRDS.—THE DOVES (*Columbæ*).

In many respects the order *Columbæ* resembles the Gallinaceous birds, or *Gallinæ*; but there is a fundamental difference between these two orders in the way in which the young are hatched, the nestlings of the Game-birds being very active and able to shift for themselves on their escape from the egg, while the young of the Pigeons are born naked and helpless. It is probably owing to a certain superficial resemblance in the form of the bill, and possibly to the resemblance between the Crowned Pigeons and some Game-birds, that these two orders have been so generally allied together in modern classifications. In the Pigeons the bill is formed not unlike that of the Plovers, the basal part being bare and covered with a thick soft skin; the apical part of the bill, however, is horny and hard in texture, convex in shape, and higher than the soft part. The nostrils are placed rather low in the soft part, near the base of the bill, and are longitudinal in shape.

The *Columbæ* may be divided into three families, as detailed below :—

THE FIRST FAMILY OF THE PIGEONS.—THE DODOS (*Didide*).

As everybody knows, the curious Pigeon called the Dodo is now extinct. As far as we are aware its range was always very restricted, being confined to the southern portion of the island of Mauritius. In size the Dodo was a little larger than a Turkey, and was incapable of flight, although it is said to have progressed rapidly over the ground. Mr. Strickland* gives the following account :—“In 1644 the Dutch first colonised the island of Mauritius, and it is probable that these gigantic fowls, deprived of flight, slow of foot, and useful for food, were speedily diminished in number, and finally exterminated, by the thoughtless rapacity of the early colonists. Their destruction would be further hastened, or might be mainly caused, by the dogs, cats, and swine which accompany man in his migrations, and are speedily naturalised in the forests. To such animals the eggs and young of the Dodo and other birds would be a dainty treat; and that this is no mere conjecture is proved by Leguat, who tells us: ‘Here (in Mauritius) are hogs of the China kind. . . . These beasts do a great deal of damage to the inhabitants by devouring all the young animals they can catch.’ That the destruction of the Dodos was completed by 1693 may be inferred from the narrative of Leguat, who in that year remained several months in Mauritius, and enumerates its animal productions at some length, but makes no mention whatever of Dodos. He further says: ‘L’isle était autrefois toute remplie d’Oyes et de Canards sauvages; de Poules d’Eau, de Gelinottes, de Tortues de mer et de terre; mais tout cela est devenu fort rare!’ This passage proves that even in 1693 civilisation had made great inroads on the fauna of Mauritius.

“In 1712 the Dutch evacuated Mauritius, and the French colonised the island under the new name of Isle de France. This change in the population will account for the absence of any traditionary knowledge of so remarkable a bird among the later inhabitants. All subsequent evidence is equally

* Strickland and Melville: “The Dodo and its Kindred,” p. 27.

negative. Baron Grant resided in Mauritius from 1740 to 1760; and his son, who compiled the 'History of Mauritius' from his papers, states that no trace of such a bird was to be found at that time. M. Morel, a French official who resided there previously to 1778, and whose attention seems to have been drawn to the subject by the judicious criticisms of Buffon, tells us that the oldest inhabitants had no recollection of these creatures. The late M. Bory de St. Vincent remained for some time in Mauritius and Bourbon in 1801, and has left an excellent work on the physical features of these islands. He assures us that he made every possible inquiry respecting the Dodo and its allies, without gaining the slightest information from the inhabitants on the subject. At a public dinner at



THE DODO.

the Mauritius in 1816, several persons from seventy to ninety years of age were present who had no knowledge of such a bird from recollection or tradition. Mr. J. V. Thompson also resided for some years in Mauritius and Madagascar previously to 1816, and he states that no more traces of the existence of the Dodo could then be found than of the truth of the tale of Paul and Virginia, although a very general idea prevailed as to the reality of both. This list of negative witnesses may be closed with the late Mr. Telfair, a very active naturalist, whose researches were equally conclusive as to the non-existence of Dodos in Mauritius in modern times."

Besides the Dodo of Mauritius, which island appears to have contained other extinct wingless birds, there existed in the neighbouring island of Rodriguez another remarkable Pigeon, called the Solitaire (*Pezophaps solitarius*), of which a number of relics were brought to England by the naturalist attached to the Transit of Venus Expedition of 1874, so that nearly perfect skeletons of male and female birds are now to be seen in the gallery of the British Museum.

In the Samoan Islands, far from the Mascarene group which contained the flightless pigeons, whose ill-developed wings afforded them no protection against the cats and pigs of the colonists, there exists at the present day a bird which is not distantly related to the extinct Dodo. This is the Tooth-billed Pigeon (*Didunculus strigirostris*), a species which seemed a few years ago to be decreasing in numbers, owing to its living upon the ground, when the bird became liable to the fatal onslaughts of cats during



THE SOLITAIRE.

the night, while its eggs ran the risk of destruction by rats. Within the last ten years, however, this pigeon has entirely changed its habits, roosting and breeding on high trees. The Rev. S. J. Whitmee, to whom we are indebted for our knowledge of the habits of this species, attributes to it considerable intelligence. "This intelligence," he writes, "seems to have enabled the bird to change its habits for self-preservation. It has probably been frightened when roosting, or during incubation, by the attacks of cats, and has sought safety in the trees. Learning, from frequent repetition of the fright, that the ground is a dangerous place, it has acquired the habit of building, roosting, and feeding upon the high trees; and this change of habit is now operating for the preservation of this interesting bird, which was a few years ago almost extinct."

THE SECOND FAMILY OF THE PIGEONS.—THE COLUMBIDÆ, OR TRUE PIGEONS.

In this large family the bulk of the Pigeons, some four hundred in number, are located. All of them have the nostrils narrow in shape and situated close to the cutting edge of the mandible, with which they run parallel. On the upper part of the bill there is a convex soft skin, which forms a tubercle. Sundevall divides the true Pigeons into four divisions; in the first are included all the Fruit Pigeons, which are inhabitants of the tropical portion of the Old World, and whose prevailing style of colour is green. They all have the tarsus shorter than the middle toe. There are two sub-



THE RING DOVE, OR WOOD PIGEON.

divisions of the Fruit Pigeons; in the first the bill is stouter than the tarsus, and in this division are found all the Green Fruit Pigeons, of which writes Dr. Jerdon *:—"The Green Pigeons are a well-marked division, all having a marked physiognomy, by which they can be recognised at a glance. They are of tolerably stout and massive form, and of a dull leaf-green colour, more or less varied with ashy and marone above, with yellow on the wings, and with orange or buff beneath. The eyes of most are very beautiful, being blue with a red outer circle. They are more or less gregarious, according to the species. When hunting for fruit they are continually gliding about the branches, like Squirrels; and from their strong feet they can hang over to seize a fruit, and recover their position at once by the strong muscles of their legs. When perfectly quiet they are very difficult to observe, from the similarity of their tints to that of leaves. They nidificate on trees, making a loose nest of twigs, and laying two white eggs.

A few are found in Africa and Madagascar, but the majority are denizens of India and Malaya, not extending as far as Australia; but one species at least occurring as high north as Japan, although they appear to be rare in China. They all afford excellent eating, but the skin is very tough and thick, and ought to be removed."

In the present section also occur the beautiful *Ptilopi*, which are distributed in great numbers over the islands of the Malay Archipelago, Australia, and Oceania, as well as the large Imperial Pigeons called *Carpophaga*, which have a similar distribution to the *Ptilopi*, with the exception that they extend into the Indian peninsula. "These Pigeons are of very large size, and adorned in many cases with rich and metallic colours, with the lower parts usually pale and glossless. The tarsus is very short and the feet broad, enabling them to grasp the branches well. The forehead is low in its profile, and the feathers advance on the soft portion of the bill. Their gape is wide, and they are enabled to swallow very large fruit; and the feathered portion of the chin advances far towards the

* "Birds of India," Vol. III., p. 445.

tip of the lower mandible, thus increasing the width of the gape. All those whose nidification is known lay but one egg.*

In the second division of the True Pigeons the tarsus is short, as in the previous division, feathered in front but bare at the sides; the front toes are more slender and rather smooth, the hind toe is broad at the base, and the wing is long. In this division are found the True Doves, to which belong our English Wood Pigeon, Stock Dove, and Rock Dove; the latter being the wild stock from which Domestic Pigeons have been derived. In the third division, wherein the tail is very long, graduated, and pointed, are found the Cuckoo Doves (*Macropygia*) and the Passenger Pigeon of America. This latter extraordinary bird has occasionally been met with in England; it is to be found all over the United States, and Dr. Brewer writes†:—"The Wild Pigeon appears to be almost entirely influenced in its migration by the abundance of its food, excepting in those parts of the country in which it has not been known to remain during winter. Even in these movements it is largely influenced by instinctive considerations of food. Evidently the temperature has but little to do with their migrations, as they not unfrequently move northward in large columns as early as the 7th of March, with a thermometer twenty degrees below the freezing point. In the spring of 1872 a large accumulation of these birds took place early in March in the eastern portion of New York. They were present in the forests about Albany, and were taken in such immense numbers, that the markets of New York and Boston were very largely supplied with them. They are capable of propelling themselves in long-continued flights, and are known to move with an almost incredible rapidity, passing over a great extent of country in a very short time. It is quite a common and well-ascertained fact that pigeons are captured in the State of New York with their crops still filled with the undigested grains of rice that must have been taken in the distant fields of Georgia or South Carolina, apparently proving that they must have passed over the intervening space within a very few hours. Audubon estimates the rapidity of their flight as at least a mile a minute. They are said to move in their flight by quickly repeated flaps of the wings, which are brought more or less near to the body, according to the degree of velocity required. During the love-season they often fly in a circling manner, supporting themselves with both wings angularly elevated. Before alighting, they break the force of their flight by repeated flappings. Their great powers of flight, and the ability thus given to change at will their residence, and their means of renewing a supply of food, are also thought to be



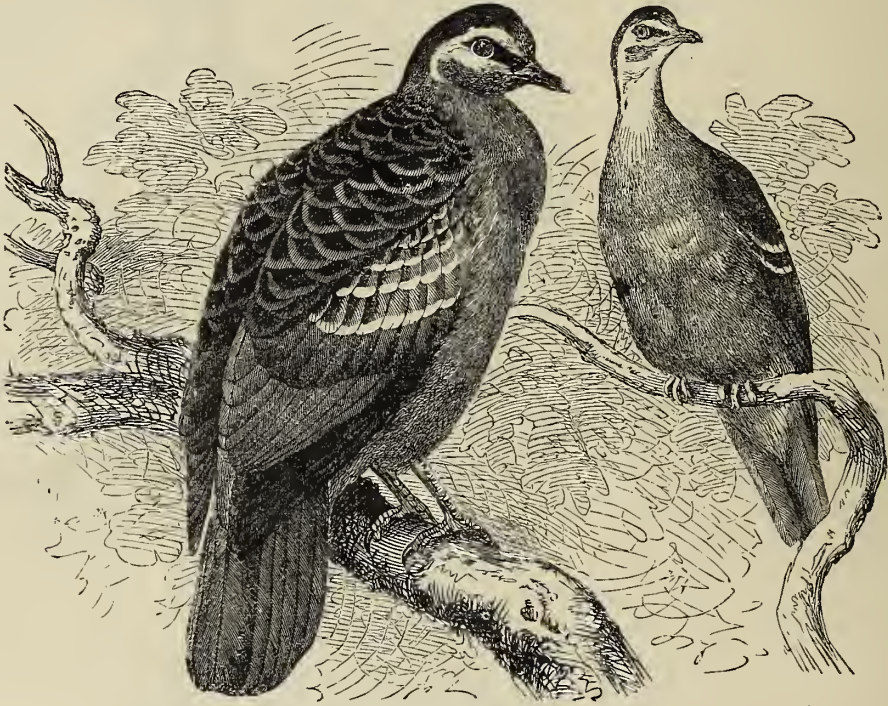
THE PASSENGER PIGEON.

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* Jerdon: "Birds of India," Vol. III., p. 455.

† "History of North American Birds," Vol. II., p. 370.

seconded by a remarkable power of vision, enabling them to discover their food with great readiness. Mr. Audubon states that he has observed flocks of these birds, in passing over a sterile part of the country, fly high in the air, with an extended front, enabling them to survey hundreds of acres at once. When the land is richly covered with food, or the trees well supplied with mast, they fly low, in order to discover the part most plentifully supplied. Several writers who have witnessed the occasionally enormous flights of these Pigeons, have given very full and graphic accounts of their immense numbers, that seem hardly credible to those who have not seen them. Mr. Audubon relates that in 1813, on his way from Henderson to Louisville, in crossing the barrens near Hardensburg, he observed these birds flying to the south-west in greater numbers than he had ever known before. He attempted to count the different flocks as they successively passed, but after counting one hundred and



THE BRONZE-WING.

sixty-three in twenty-one minutes he gave it up as impracticable. As he journeyed on, their numbers seemed to increase. The air seemed filled with Pigeons, and the light of noonday to be obscured as by an eclipse. Not a single bird alighted, as the woods were destitute of mast, and all flew so high that he failed to reach any with a rifle. He speaks of their aerial evolutions as beautiful in the extreme, especially when a Hawk pressed upon the rear of a flock. All at once, like a torrent, and with a noise like that of thunder, they rushed together into a compact mass, and darted forward in undulating lines, descending and sweeping near the earth with marvellous velocity, then mounting almost perpendicularly in a vast column, wheeling and twisting so that their continued lines seemed to resemble the coils of a gigantic serpent. During the whole of his journey from Hardensburg to Louisville, fifty-five miles, they continued to pass in undiminished numbers, and also did so during the three following days. At times they flew so low that multitudes were destroyed, and for many days the entire population seemed to eat nothing but Pigeons.

“When a flight of Pigeons discovers an abundance of food, sufficient to induce them to alight, they are said to pass around in circles over the place, making various evolutions; after a while passing lower over the woods, and at length alighting; then, as if suddenly alarmed, taking to flight, only to return immediately. These manœuvres are repeated with various indications of indecision in their move-

ments, or as if apprehensive of unseen dangers. During these manœuvres the flapping of their many thousand wings causes a reverberation suggestive of distant thunder. When at last settled upon the ground, they industriously search among the fallen leaves for the acorns and the beech-mast, the rear flocks continually rising, passing over the main body, and re-lighting. These changes are so frequent that at times the whole collection appears to be in motion. A large extent of ground is thus cleared in a surprisingly short space of time, and cleared with a completeness that is described as incredible. They are usually satiated by the middle of the day, and ascend to the trees to rest and digest their food. On these occasions the Pigeons are destroyed in immense numbers, and their abundance in large extents of the country has been very sensibly reduced."

In the fourth division of the Pigeons the tarsus is about equal to the middle toe, or longer, and is bare at the base. The tail is moderate, often short or rather long, but not pointed; the toes are rather slender. Many of these birds frequent the ground, and the colours are more delicate than in the Fruit Pigeons, or in the True Pigeons, which latter have generally an iridescent colour on the sides of the neck. They mostly feed on the ground on grain, pulse, and other small seeds, and are not in general gregarious, though large numbers may be seen feeding together. They chiefly frequent open and cultivated country,



THE VICTORIA CROWNED PIGEON.

a few preferring highly-wooded or forest districts, and many are very familiar birds, feeding close to houses and stables. They nest on low trees or shrubs, constructing the usual slight platform nest, and they breed at all seasons of the year.* Mr. Gould says that the species of *Phaps*, which are popularly known as Bronze-wings, are more widely dispersed in Australia than those of any other member of the family, being universally distributed over the country from north to south, and from east to west; even the parched deserts of the interior are visited by them if a supply of water sufficient for their existence be within reach of their evening flight, which is performed with the most extraordinary rapidity and power. Writing of the common Bronze-wing (*Phaps chalcoptera*), the same writer observes:—"It is a plump, heavy bird, weighing when in good condition fully a pound; and is constantly eaten by every class of persons resident in Australia. Its amazing powers

* Jerdon.

of flight enable it to pass in an incredibly short space of time over a great expanse of country, and just before sunset it may be observed swiftly winging its way over the plains or down the gullies to its drinking-place. During the long drought of 1839-40, when I was encamped at the northern extremity of the Brezi range, I had daily opportunities of observing the arrival of this bird to drink, the only water for miles, as I was assured by the natives, being that in the immediate vicinity of my tent, and that merely the scanty supply left in a few small natural basins in the rocks, which had been filled by the rains of many months before. This peculiar situation afforded me an excellent opportunity for observing not only the Bronze-wing, but many other birds inhabiting the neighbourhood. Few, if any, of the true insectivorous or fissirostral birds come to the water-holes; but, on the other hand, those species that live upon grains and seeds, particularly the Parrakeets and Honey-eaters (*Trichoglossi* and *Meliphaga*), were continually rushing down to the edges of the pools, utterly regardless of my presence, their thirst quite overcoming their sense of danger. Seldom, if ever, however, did the Bronze-wing make its appearance during the heat of the day, but at sundown it arrived with arrow-like swiftiness, either singly or in pairs. It did not descend at once to the edge of the pool, but dashed down to the ground at about ten yards' distance, remained quiet for a short time, then walked leisurely to the water, and, after drinking, winged its way to its roosting-place. With a knowledge, therefore, of the habits of this bird, the weary traveller may always know when he is in the vicinity of water; and, however arid the appearance of the country may be, if he observes the Bronze-wing wending its way to a given point, he may be certain to procure a supply of water. When rain has fallen in abundance, and the rivers and lagoons are filled, the case is materially altered; then the Bronze-wing and many other birds are not so easily procured."

THE THIRD FAMILY OF THE PIGEONS—THE CROWNED PIGEONS.

In this family are placed the large Crowned Pigeons (*Goura*), which inhabit the island of New Guinea and the adjacent islands in the Bay of Geelvink. They are ground-loving birds, remarkable for their large size and the beautiful crest which ornaments the head, and which has gained for them the appropriate name of "Crowned" Pigeons. In their native state they go about the woods in small parties in search of fruit, much after the manner of Pheasants.

CHAPTER VII.

THE GAME BIRDS.

GALLINÆ, GAME BIRDS—Characteristics—THE CURASSOWS—The Sub-families—Distinctive Features—Prof. Sumichrast on the Hoeco and Penelopes—THE HOATZINS—THE PHEASANTS—THE PEACOCKS—Their Gorgeous Plumage—The so-called Tail—Is the Peacock vain?—Dr. Jerdon's Account of the Habits of the Peafowl—The Peacock Pheasants—The Argus Pheasants—THE TRUE PHEASANTS—Description of the Habits of the Monaul, or Impeyan Pheasant—Coloration of Bird—Habits of the English Species of True Pheasant—Reeves's Pheasant—THE GUINEA FOWLS—Distinctive Features—THE TURKEYS—Characters—Species—Dr. Brewer's Account of the Habits of the Wild Turkey—Migration of Turkeys—THE GROUSE AND PARTRIDGES—THE GROUSE—The Capercailzie—The Black Cock—The Hazel Grouse—The Ptarmigan—Its Summer, Autumn, and Winter Plumage—The Willow Grouse—THE PARTRIDGES—Distribution—The Frankolins—The American Partridges—The Californian Quail—The Common Partridge—The Snow Partridges—THE QUAIL—THE SAND-GROUSE—THE HEMIPODES—THE MEGAPODES—Their Large Feet—Distribution—Members of the Family—Brush-Turkey—Mr. Wallace's Account of the Maleo—Cuming's Megapode—Mr. Motley's History of the Species—Gould's Description of the Habits of the Mound-raising Megapode of Australia—Moseley's Note on the Incubation of the Megapodidæ.

FIFTH ORDER OF THE CLASS AVES—GALLINÆ—GAME BIRDS.

No less than eight distinct families are comprised in this fifth order of birds. The head is small in proportion to the size of the body; the bill is short with a soft skin covering the nostrils; the line of the bill is arched, and the nostrils, generally of large size, are placed low down in the mandible. The feet are always very distinctly scaled. Members of the order of Game-birds vary considerably in size, large forms like the Turkey, and little creatures scarcely larger than a Sparrow, such as Button-quails and Hemipodes, being equally included in the order. They are generally omnivorous, scratching the ground in order to obtain the small worms, insects, and grain, on which they

subsist. Instead of washing themselves in water, the game-birds generally dust themselves in mould or sand. The eggs are numerous, and are generally placed on the ground without any attempt at forming a nest, and as a rule the game-birds are polygamous. When the chickens are hatched they are able to shift for themselves, and are in most respects stronger than the young of other birds.

THE FIRST FAMILY OF THE GAME BIRDS—THE CURASSOWS (*Craciæ*).

These birds are found only in the Neotropical regions, being confined to Central and South America. About fifty species are known, and they are divided into three sub-families, the *Cracinae*,



THE CRESTED CURASSOW.

or true Curassows; the Guans (*Penelopinae*); and the Mountain Curassows (*Oreophasinae*). Many of the Curassows are very beautiful birds, having large curly crests and fleshy knobs on their bills. In colour they are sombre, being black and white, or dusky grey, the only ones at all brightly coloured being some of the females of the genus *Crax*. The following is a translation of Professor Sumichrast's note on the habits of two Mexican species:—

“The Hocco (*Crax alector*) is called the Royal Pheasant by the Mexicans. It is very common in the large forests of the eastern coasts, and in Yucatan, but it does not appear to live on the western slope of the Cordilleras, or, at least, I have never seen it there, and the inhabitants could tell me nothing positive on this subject. These birds are usually to be seen in couples or in little companies, at least at one time of the year they are thus to be observed. They are less fierce than the Guans; and they are to be seen more often walking about on the ground, and during the dry season, that is to

say, during the months of March, April, and May. They are very fond of rolling themselves in the dust, like game-birds in general. Their principal food consists of small worms, various seeds, and wild fruits. The males commence to seek the females from the month of January, and the time of love lasts until the end of March. The males are heard calling out in the woods with a loud and strong cry, and uttering a sound which can be best described as *baoum-baoum*. At this season the pursuit of the Hocco becomes very easy, the reason being that with them their amatory desires are much greater than their instinct of preservation, so much so that they lose all foresight, allow themselves to be approached closely, and do not trouble themselves much about what is passing around them. Sometimes several males surround a female and do not desert her even though they perceive the hunter. When we come across one of these little groups collected together in the cause of love, were it possible to kill the female at the first blow, it would be seen that the males rarely take flight; on the contrary, they remain in a state of stupor at the side of the body of the female, and do not disperse till another discharge attacks them. The little fear that man inspires in these game-birds is, without doubt, the reason they are so easily tamed. I can never understand why this bird is not an inhabitant of the poultry-yard like the Turkey, for it is certainly suited for a domestic state, and the adults, although taken wild, soon become tame; the young ones carried away from the nest, or hatched by the mother bird, become as familiar as chickens, and even more so, as they allow themselves to be caressed, and even take their food from the hand of man. It must be that the natives have found the Turkey, which is a bigger bird, sufficient for their wants, or discovered that the Hocco does not multiply easily under the conditions of a domestic life. This bird builds its nest on the trees, and is never very productive. In March the couple constructs on a high tree a thick nest of twigs; the female deposits only two eggs, which she takes about a month to hatch. The little ones, once hatched, do not leave their nest till they know how to fly, as likewise do the game-birds, who nest on the ground, but the parents bring them worms and insects. As soon as they begin to know how to use their wings, which is about the end of April, the whole family goes off to seek their fortune, and in quest of ripe fruits, such as chichazapoles, and different kinds of oranges, &c. Wild oranges seem to have a special attraction for them, and in the narianjules, or places in the forests where the tree grows which bears them, the Hocco is generally to be found. In the same forests in hot countries where the Hocco is met with live also the Penelopes, who are even still more common: these are named Cojolites by the Indians. Their manners much resemble those of the Hocco; they make their nest and follow the incubation in the same manner; they, however, sometimes lay three eggs. They live also in large companies, are more mistrustful, perch more, and utter a great many cries. During the day these birds keep themselves in the interior of the forests looking for fruits; morning and evening they approach the border of the woods, crying out very loudly, and several at a time; it is on this account the Spaniards call them Squalling Pheasant. The flesh of the Penelopes is more tender, less dry than that of the Hocco, and, for this reason, esteemed more choice. It is said that their bones, cooked or raw, are a poison for dogs. I must, however, say I have never been able to prove the truth of this surprising fact. To the species Penelopes should be also added another called by the Indians 'Tchitchalague,' which is found in still greater abundance. This one also lives in families, leads the same kind of life, and is still less fierce. It is to be feared that all kinds of these game-birds will end gradually by growing very scarce, for the excellence of their flesh as food will make them a constant prey to the hunter; and this will be more the case as the Continent of America becomes populated. The facility with which they are shot, joined to their slight increase, will form a rapid cause for their destruction in the future, happily still distant, when the grand forests will disappear from Mexican soil."

The third sub-family of the Curassows contains only the single genus *Oreophasis*, represented in its turn by only one species, the Mountain Curassow (*Oreophasis derbianus*), an inhabitant of Guatemala, in Central America. In the latter country it is very rare, and confined to narrow limits, being found on the mountains between 7,000 and 11,000 feet above the sea-level. The first specimen was in the collection of the late Earl of Derby, after whom it was named.

THE SECOND FAMILY OF THE GAME-BIRDS—THE HOATZINS (*Opisthocomidae*).

The position of the singular bird, which is the sole representative of this family, has been a source of some speculation with systematic naturalists, but since its osteology and general anatomy have

been studied more completely, it is now generally admitted that the Hoatzin is a game-bird, and yet exhibits certain affinities to the Touracoes (*Musophagidae*). The scientific name of the Hoatzin is *Opisthocomus cristatus*, and it is an inhabitant of Guiana and the Amazon region, where it assembles in large flocks. It nests in the lower part of a tree, the eggs being three or four, white, spotted with reddish tint.

THE THIRD FAMILY OF THE GAME-BIRDS—THE PHEASANTS (*Phasianidae*).

The present family includes some game-birds differing in appearance, such, for instance, as the Peacocks, the Jungle-fowl, and the Guinea-fowl: in fact, Mr. D. G. Elliot, who has written a large work on the subject, recognises no less than eight sub-families, including also the Turkeys among the number. Three sub-families may easily be recognised—the Peacocks (*Pavoninae*), with their elongated tails, and general tendency to an “ocellated” plumage, exhibiting the large rounded metallic spots, or “ocelli,” which are so marked a feature in the Peacocks and Argus Pheasants; secondly, the true Pheasants (*Phasianinae*); and thirdly, the Guinea-fowls (*Numidinae*).

THE FIRST SUB-FAMILY OF THE PHASIANIDÆ, OR PHEASANTS.

THE PEACOCKS (*Pavoninae*).

The true Peacocks are Asiatic birds, and in some parts of India are very abundant, being, as a rule, unmolested by the natives, who have a great dislike to their being killed. Large flocks may, therefore, often be seen; and the birds are described by Indian naturalists as being even more beautiful in a wild state than they are in a domesticated condition, though it is well known what an ornament they are in gardens in this country. Scarcely anything more gorgeous can be met with in the whole range of bird-life than a male Peacock in full plumage; and the bird seems to be conscious of the admiration he excites, when he displays his long plumes, and gently rustles them, to give effect to the beautiful “eyes,” or “ocelli,” which ornament his train. The long feathers which he expands in the shape of a fan are not, as is so often stated, the Peacock’s tail; but are simply the upper tail coverts prolonged to a prodigious extent: the true tail-feathers being very much shorter, and serving, when spread, as a support to the fan-like disc, which constitutes so splendid an attraction in these birds. As a rule, however, the stigma which attaches to the Peacock of being a vain bird—a saying quite proverbial—is scarcely deserved, as the bird is no more vain than any other game-bird at the season of love. It is to his mate that the Peacock generally shows himself off to the best advantage; though at the sight of another male displaying his tail the bird will often commence to spread his own plumes. That the object is to endear himself to the female is seen by the way in which he walks slowly in front of her, turning when she turns, and gently quivering his fan as if to attract her attention; and it is not an unusual sight to see three or four birds in the Zoological Gardens displaying themselves at one and the same time.

“The Peafowl,” writes Dr. Jerdon, “inhabits the whole of India proper, being replaced in Assam, and in the countries to the east, by another species. It frequents forests, and jungly places, more especially delighting in hilly and mountainous districts; and in the more open and level country, wooded ravines, and river banks are the never-failing resorts. It comes forth to the open glades and fields to feed in the morning and evening, retiring to the jungles for shelter during the heat of the day, and roosting at night on high trees. It ascends the Neilgherry and other mountain regions in Southern India to 6,000 feet or so of elevation; but it does not ascend the Himalayas, at all events in Sikkim beyond 2,000 feet. In many parts of the country it is almost domesticated, entering villages, and roosting on the huts, and it is venerated by the natives in many districts. Many Hindoo temples have large flocks of them; indeed, shooting it is forbidden in some Hindoo states. The Peafowl breeds according to the locality; from April till October generally in Southern India; towards the close of the rains laying from four to eight or nine eggs in some sequestered spot. The Peacock, during the courting season, raises his tail vertically, and with it, of course, the lengthened train, spreading it out and strutting about to captivate the hen birds; and he has the power of clattering the feathers in a most curious manner. It is a beautiful sight to come suddenly on twenty or thirty Peafowls, the males displaying their gorgeous trains, and strutting about in all the pomp of pride before the gratified females. The train, of course, increases in length for many years at each



THE ARGUS PHEASANT.



successive moult; but it appears to be shed very irregularly. Though it cannot be said to be a favourite with sportsmen in India, few can resist a shot at a fine Peacock whirring past when hunting for small game. Yet Peachicks are well worth a morning's shikar for the table, and a plump young Peahen, if kept for two or three days, is really excellent. An old Peacock is only fit for soup.

A bird merely winged will often escape by the fleetness of its running. They generally roost on particular trees, and by going early or late to this place they can readily be shot. Peafowl are easily



THE PEACOCK PHEASANT.

caught in snares or common hair nooses, and are generally brought in alive for sale in numbers in those districts where they abound. In confinement they will destroy snakes and other reptiles, and in their wild state feed much on various insects and grubs, also on flower buds and young shoots, as well as on grain.

In the same sub-family are to be found the Peacock Pheasants (*Polyplecton*), which inhabit the eastern Himalayas and the mountains of the Indo-Malayan islands. In colour they are brown, as a rule, but the tail has a number of green or purple spots, like the "ocelli" of a Peacock, and this peculiarity has gained for them the popular title of "Peacock" Pheasants. Finally, with the Peafowl must be placed the magnificent Argus Pheasants, of which there are two species known, the common Argus from Malacca, and the Gray's Argus from Borneo. In its wild state the Argus Pheasant is seldom or never seen, but it is frequently trapped by the Malays, who set springs in the woods where they see the track of a Pheasant, and thus capture not only the Argus but all sorts of

birds, Fire-backed Pheasants, Ground Cuckoos, and even Pittas, or Ant-Thrushes. Within recent years the Argus has been successfully brought over to Europe, and has even bred in our Zoological Gardens, though the eggs have to be hatched under a domestic fowl, as the female does not always show a disposition to sit. The number of eggs in confinement appears to be two, and the young have proved to be excessively difficult to rear. Two, however, lived for some time in the Zoological Gardens in the Regent's Park, and the male chick could be recognised from the female at an early stage by his larger size and brighter colour. They begin to fly very early, and when only four or five days old could mount a high perch, and rest under the wing of the old bird.

THE SECOND SUB-FAMILY OF THE PHASIANIDÆ, OR PHEASANTS.

THE TRUE PHEASANTS (*Phasianinæ*).

This is by far the largest of the three sub-families, and contains all the Impeyan Pheasants, or Monauls, the Firebacks, and the Pheasants proper, of which our own bird is a type, and indeed all the members of the family which are not included in the Peacocks or the Guinea-fowls. By far the most splendid of this group of Pheasants are the Monauls (*Lophophorus*), which inhabit the hill-ranges of the Himalayas and Assam, as far east as western China, but always high up in the mountains. An excellent observer, under the signature of "Ornithognomon," has given a very good account of this Impeyan Pheasant, or Monaul of the Himalayas :—

"The Monaul ranges high in the mountains, where it is found keeping near the line of snow, and, although met with in the ridges next the plains, becomes much more numerous farther in the mountains. It frequents the entire range of the Himalaya, from Afghanistan to Sikkim, but does not extend along the great branch running south through Burmah and Malayana. Its range in elevation varies according to season ; but in the severest winter it does not appear to descend below 6,000 feet above sea level. I have seen numbers in Nepaul in winter, brought with other kinds of Pheasants by the Botias for sale in the plains of India, where they soon perish when the hot weather begins. The gradual increase of our hill stations in the Himalaya, and the unwearying excursions of our sportsmen, are driving these birds from the vicinity of our settlements into the more inaccessible mountains of the interior. Formerly, about Mussouri and Landour, it was not thought a great feat to bag a few in a day's work ; but now they have to be sought much farther. They are forest birds, and difficult to be found in summer, when vegetation is profuse, unless by ascending to the highest limits of the forest, when shots may be obtained in the open downs above, and amongst the rocks and thin herbage near the snow. In autumn, as the underwood decays, they descend and scatter through the woods, sometimes in great numbers, and seek lower levels as the winter advances, and the soil becomes frozen. At such times they draw near to the small villages, perched on the lower spurs and above the sheltered valleys, and seek their food in the fields, where the mountaineers, with their large hoes, have dug up the soil. In these seasonal migrations it has been remarked that the females and young birds descend lowest, and approach nearest to human habitations. The old birds are shyer and wilder, and many remain high up, even where the ground is deeply covered with snow.

"They appear to be either capricious in their rambles through the woods, or are actuated to particular spots at particular times, for reasons not apparent. Sometimes the sportsman will put up in one part of the forest fifteen or twenty in the space of four or five acres. In another portion he may keep on flushing, for the rest of the day, single birds feeding in solitude far apart. At no time are they gregarious ; and whenever alarmed, they rise and escape independently of each other. In some parts only cock birds are found, in others only hens—and these last, as before remarked, together with young birds, always nearest to habitations, and in opener slopes of the mountains, more accessible to the sportsman. Severity of cold and scarceness of food have their taming effects on the Monaul, as on other birds ; and the lower the snow the easier the task of making a bag. But, in fact, the Monaul is not nearly so wild as the Tragopan, the Euplocamus, the Polyplectron, the Macartneya, and other genera of Pea-fowl and hill Pheasants. Its habits are more open ; and instead of skulking in such impermeable cover as is described in my remarks on Polyplectron tibetanus (or chinquis), it walks about pretty openly in forest glades clear of underwood. At the same time it must be observed that the absence of cover enables it to espy the sportsman at a distance ; and it takes to wing frequently out of shot, which I have never seen any other bird of this family do. When on the

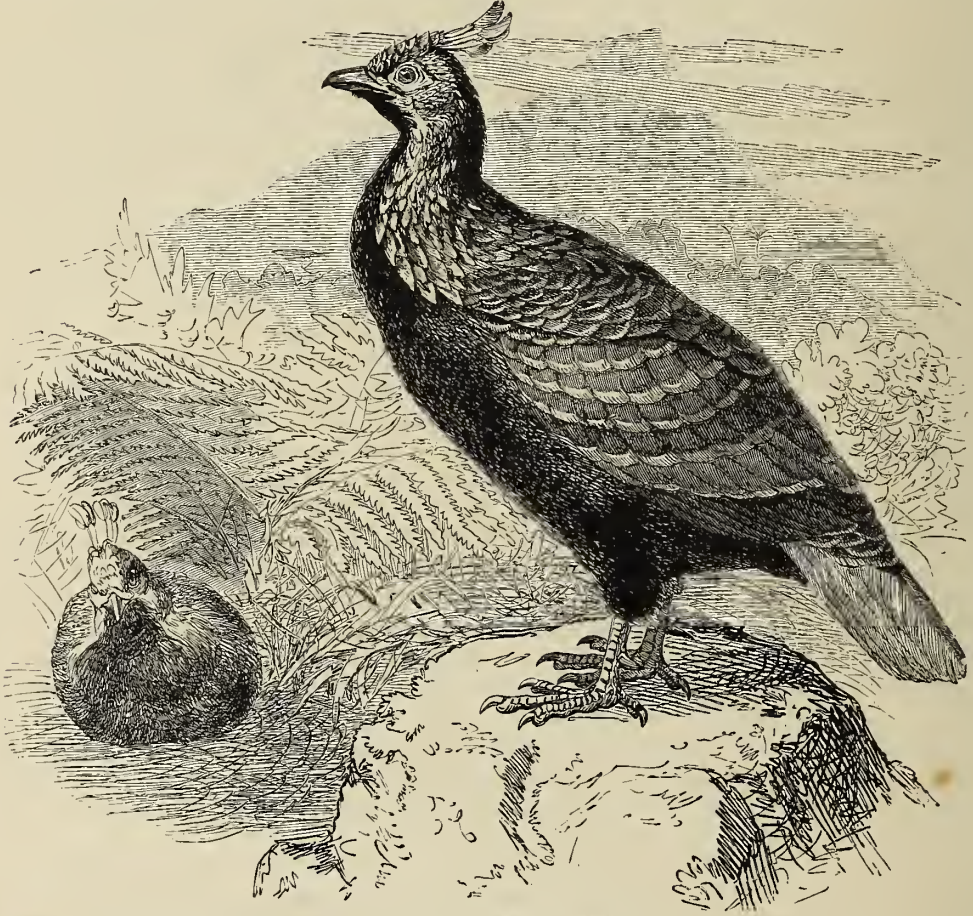
wing, it generally flies a long way, and, if much alarmed, crosses over to a parallel ridge. Occasionally, however, it will settle on the low limb of a tree at no great distance; and once there, it is, like many other gallinaceous birds, easy of access. Sometimes, when approached in open spots, it walks off or begins to move, stopping often and eyeing the intruder, till suddenly, and without apparent immediate cause, it will rise with a startling flapping or flutter of the wings, scattering the dead leaves in a shower around, and fly headlong into the wood with a succession of short piercing shrieking whistles, which appear to act as a warning to some distant companions; for their calls are often heard in reply. When feeding quietly and in security the Monaul has a sweet mellow call, a long plaintive note which it utters from time to time, especially of a morning and after sunset. It has the same melancholy effect on the ear as the creaking whistle of the Curlew, winging his way along the mud-flats as evening settles over the lonely shore. The Monaul breeds towards the end of spring. The courtship is carried on in the chestnut and large timber forests before the birds ascend (during the summer heats) towards the regions of perpetual snow. It is generally near the upper limits of these forests, where the trees are dwarfed and sparingly scattered, that the hen lays and incubates three to five eggs, in a depression on the ground. Whether any nest is made, Dr. Jerdon did not know, but 'Mountaineer' says the female makes one 'under a small overhanging bush or tuft of grass.' The eggs are of a dull cream or pale buff colour, sprinkled with reddish-brown. Like most gallinaceous birds, the Monaul may be said to be omnivorous. 'Mountaineer' says it will not touch wheat and barley, but those kept in confinement ate rice and grain readily, as well as insects, worms, maggots, flesh, lizards, fish, eggs, &c. It is a diligent digger, and the slightly expanded tip of the mandible acts like a hoe or shovel. I had several of these birds in an aviary at Mullie in Sirhoot. They were strong and vigorous as long as the cold weather lasted, and soon became tame, unlike the red Pheasants (*Cerionis*) purchased at the same time from the Botias passing through the station, which never lost their original wildness, and began to droop about April; whereas the Monauls did not succumb to the atmosphere of the plains till June, when the rains had set in. Unlike the smaller hill Pheasants, they were not pugnacious.

"If shipped off early in the cold weather from Calcutta, these birds could easily enough be transported to England, where the temperature would suit them, if there were any means of giving them shelter during the extreme severity of winter, or of procuring for them in that season a proper substitute for the insect food which never fails them on the lower elevations of the Himalaya. If they could become as thoroughly acclimatised as the common Pheasant, they would indeed be a superb ornament to our parks and plantations, though perhaps no great acquisition to the table. It is many years since I tasted the Monaul, and speaking from memory, the flavour appeared to me much the same as that of the Peafowl, the breast being tender and palatable in the young birds, but no part being fit for anything but soup in old specimens. The Monaul has bred in England both in the Zoological Gardens of London and in the possession of the Earl of Derby, where the female is said to have laid on one occasion thirteen or fourteen eggs."

The Monaul is a splendidly-plumaged species, having on the head a crest of metallic-green plumes like those forming the crown of a Peacock; the neck is purple, shot with green, and in some lights with golden copper; middle of the back white; wings black, the coverts, like the back, glossed with purple and green; rump and upper tail-coverts rather more purple; tail cinnamon; underneath black, the throat glossed with green and purple; naked skin round the eye blue; bill dark horn-colour; legs dull ashy-green; eye brown. The length of the bird is about two feet and a half, and as in most of the Pheasants, the hen is much plainer in colour, being brown, varied with black spots and bars; upper tail-coverts white at the end, as also the tip of the tail; chin and throat white.

The true Pheasants (*Phasianus*), to which our English species belongs, are widely spread over the Palearctic region, and reach their highest development as regards number of species in Central Asia and China, where numerous kinds of true Pheasants are found, all of them more or less like the English bird in appearance. One of the most familiar is the Chinese Ring-necked Pheasant, which is often crossed with the English bird: indeed, this cross-breeding has been carried to such an extent in this country, that thoroughly pure-bred birds are now becoming rarer and rarer. The original home of the English Pheasant was the neighbourhood of the river Colchis, and hence its specific name of *Phasianus colchicus*, and it is still abundant in its original habitat.

It is doubtful whether the Pheasant would survive in England if left entirely to itself, as it depends a good deal on the amount of artificial food which is supplied to it in preserves, while most of the rearing of the young is entrusted to the care of domestic fowls instead of being left to the protection of the hen Pheasant. The latter has many enemies, and nesting as it does on the ground, runs great risk of being carried off by a prowling fox or cat. The eggs are from ten to fourteen in number, and are of an olive-brown colour; they are placed on the ground, and there is scarcely any attempt at a nest. The sitting-bird is said to be timid, and is frightened off the nest even by such a small thing as a crawling snail, while at any real danger she sinks upon the



THE MONAUL, OR IMPEYAN PHEASANT.

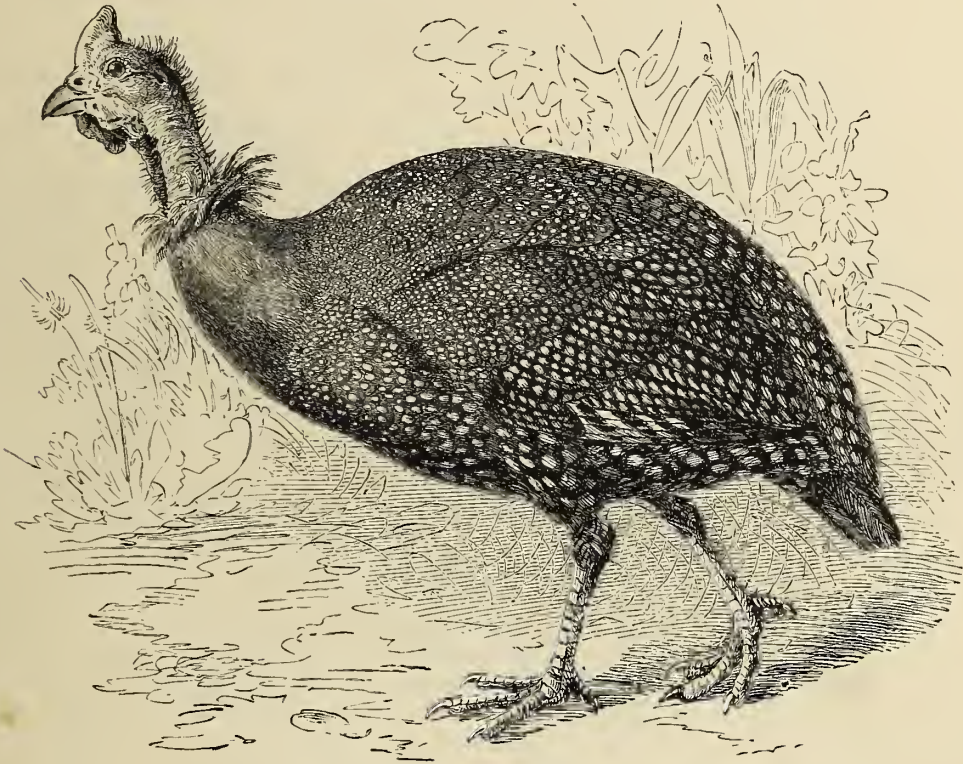
nest half dead with fear. Timidity is a great characteristic of the common Pheasant, and even when artificially reared in hen-coops, the young birds never become tame like chickens, but always come for their food in a timid and half frightened manner. As a rule, the Pheasant frequents the thick woods for the purpose of roosting only, as in the daytime it seeks its food, which consists of grain, seeds, green shoots, and insects, among hedge-bottoms and thickets with long grass and tolerably dense undergrowth; it also affects damp ground and osier beds. In the spring the cock bird is often heard crowing, and at that season of the year he comes out from his woodland retreats and is often seen in the open. The Pheasant is polygamous, and is very tenacious of his own domain, driving every other male bird of his species away. At this season his plumage is very beautiful, and the red comb at the sides of his head becomes more brilliant in colour.

The splendid Reeves' Pheasant (*Phasianus reevesii*) must also be mentioned. It is a native of China, and is remarkable for its long banded tail, which often exceeds five feet in length.

THE THIRD SUB-FAMILY OF THE PHASIANIDÆ, OR TRUE PHEASANTS.

THE GUINEA-FOWLS (*Numidinae*).

The Guinea-fowls are all natives of Africa and Madagascar. They are very similar in plumage, being of a dark-grey colour, covered all over with round spots of white, generally larger on the back and under-surface of the body. The outer quills are white in most of the species, and show conspicuously when the birds are flying. The head is ornamented with a helmet or horny crest in some of the species, whilst others have lappets, and others naked red skin on the face, which gives them a handsome appearance, this being often enhanced by a tuft or top-knot on the crown. In their habits, in a wild state, the Guinea-fowls are not unlike Pheasants, the female, on being disturbed,



THE GUINEA-FOWL.

flying off and leaving her little ones, who immediately conceal themselves of their own accord. They are found in many parts of Africa in rocky localities amongst ravines and stony places. The flesh is much appreciated for food. The voice of the Guinea-fowl is harsh, as any one must know who has heard the peculiar call of the species in this country. They are extremely shy, and when feeding in the open will speedily scent danger, one first uttering his loud cry *Come back!* and then running a little way, quickly followed by the whole flock, which, after doubling a short distance, will make for the nearest place of safety.

THE FOURTH FAMILY OF THE GALLINÆ, OR GAME BIRDS.

THE TURKEYS (*Meleagridæ*).

By some writers the Turkeys are considered to belong to the Pheasants, of which they form a sub-family, but it seems better to keep them as a distinct family, representing in America the Phasianidæ of the Old World. They are the largest of game-birds, and on that account have been domesticated for a great length of time. Their English name of Turkey is supposed to have been

given them on a supposition of their coming from that country, but they are really inhabitants of America ; they were first introduced into England about the year 1541.

All the Turkeys have the head naked, with wattles, or folds, of bright naked skin, which becomes much more brilliant when the bird is excited or angry ; they have also a curious tuft of long hairs on the breast. The plumage of the Turkeys is always more or less metallic, and the wild birds are much finer than the domestic race, which does not seem to have improved under the hand of man. There are only three species of Wild Turkey known, the Common Turkey (*M. gallopavo*), the Mexican



THE OCELLATED TURKEY.

Turkey (*M. mexicana*), and the Ocellated Turkey (*M. ocellata*), the last being a very fine and brilliantly coloured bird with metallic plumage. It is found in Honduras and Yucatan.

"The Wild Turkey," writes Dr. Brewer, "is found throughout Eastern North America from South Carolina northward, and from the Atlantic to Texas and Arkansas. It has probably become an extinct species in New England, though within a few years individuals have been shot in Montague, Mass., and in other towns in Franklin county. The construction of railways, however, and the settlement of the country, have probably led to their final extermination ; at least, I have known of none being taken within the limits of Massachusetts for several years. In the unsettled portions of the Western and Southern States, and in the country watered by the Mississippi and the Missouri rivers and their affluents, these birds are comparatively plentiful, though the question of their final extinction is probably only one of time, and that not very distant."

Mr. Audubon, in his very full and minute account of their habits, speaks of them as irregularly

migratory and gregarious, their migrations having reference only to the abundance of food, and their meeting together in the same localities being, to a large degree, caused by the same source of attraction—the supply of mast in certain regions. In this way they desert sections where the supply is exhausted, and advance towards those where it is more plentiful. Late in October these birds assemble in flocks in the rich bottom lands of the Western rivers, the male birds associating in parties of from ten to a hundred, and keeping apart from the females. The latter are simultaneously moving into the same regions, but only in small family groups, each leading its own flock, then nearly grown. These migrations are made on foot, except when they are compelled to cross a stream. On their first coming to the banks of a river they are said to make a pause there of one or two days before they attempt to cross, the old males strutting about up and down the banks, making a loud gobbling, and calling one another, as if to raise their courage to a befitting point. Even the females and the young assume something of the same pompous demeanour, spreading out their tails, running round one another, and making a loud purring noise. At length, after this prolonged preparation for their passage, they all mount to the top of a high tree, and at a signal given by their leader, take flight for the opposite shore. Occasionally some fall in the water, when they bring the wings close to the body, spread out the tail, and plying the legs with great vigour move rapidly towards the shore, where, by a violent effort, they extricate themselves from the water. After thus crossing a stream of any magnitude they are often found in a bewildered state, and fall an easy prey to the hunter. Where their food occurs abundantly they separate into smaller flocks, composed of birds of all ages and sexes. At times they are known to approach farm-houses, associate with the domesticated fowl, and enter the corn-cribs in quest of food, passing the fall and the winter in this manner.

Early in February the love-season is said to commence, the first demonstrations being made by the males, but for some time persistently avoided by the females; at this period the sexes roost apart. When a female utters a call-note the male birds within hearing return the cry, uttering notes similar to those with which the domestic Turkey greets any very unusual sound. If the call-note has been uttered by a female on the ground, the males fly to the place, spreading and erecting their tails, drawing their heads back on their shoulders, depressing their wings with a quivering motion, and strutting pompously about. At the same time they emit from the lungs a succession of very peculiar puffs. On these occasions the males often encounter each other, and desperate contests ensue, which frequently have a fatal termination, caused by furious blows inflicted on the head. When one cock Turkey has thus destroyed its rival, it is said to caress the dead body in an apparently affectionate manner.

When the Turkeys have mated, the alliance is supposed to last for the season, though a male Turkey is often known to have more than a single mate; and the hens are said also to keep apart from the males while they are laying their eggs, for the cock would inevitably destroy them. At the end of the love-season the males become emaciated, and cease to gobble. They then separate entirely from the females, and keep apart by themselves until they recover, when they re-unite in small flocks. The female begins to deposit her eggs about the middle of April, selecting for that purpose a place as much concealed as possible from her many enemies. The nest, always on the ground, consists of a few withered leaves in a hollow scratched out by the side of a fallen log, or the top of a prostrate tree, or under a thicket, or within the edge of a cane-brake, but always in a dry place. The eggs are from ten to fifteen in number, but are sometimes as many as twenty. On quitting the nest the hen bird covers them with leaves. When the young are hatched the old mother shows great solicitude, guarding them carefully from wet, which is injurious to the chicks.

The food of the Turkey in a wild state is stated by the author above quoted to consist of grass, various kinds of plants, corn and other grain, seeds, fruit, and also upon beetles, small lizards, tadpoles, &c., with a preference for pecan-nuts and wild grapes to any other kind of food. The young usually feed on small berries and insects.

In confinement the Turkey has kept wonderfully close to the colour of the parent stock, but some domestic races are known. In the British Museum is a light-brown race with a large top-knot like a Polish fowl. This same race was figured in a work on birds one hundred and twenty years ago.



THE CAPERCAILLIE.

THE FIFTH FAMILY OF THE GALLINÆ, OR GAME BIRDS.

THE GROUSE AND PARTRIDGES (*Tetraonidæ*).

The Grouse differ from the Partridges chiefly in their feathered toes, and in having the nostrils shut in by a soft feathered skin, whereas the Partridges have an open nostril and bare legs. None of the members of the Grouse or Partridges have spurs.

THE FIRST SUB-FAMILY OF THE TETRAONIDÆ—THE GROUSE (*Tetraoninæ*).

These birds are entirely peculiar to the northern parts of the Old and New Worlds. In Europe the most familiar species are the Red Grouse, the Ptarmigan, the Hazel Grouse, and, above all, the Black Cock and Capercaillie; whilst in North America, in addition to the White Grouse and Ptarmigan, there are several fine kinds, such as the Pinnated Grouse, the Canada Grouse and others. The Capercaillie (*Tetrao urogallus*) is the largest species which we have in Europe, where it is found most plentifully in the forests of the north; but it is also met with in the pine-forests of Central and Southern Europe, and is known to inhabit the Pyrenees. In the extreme east of Siberia it is represented by a second species (*Tetrao urogalloides*).

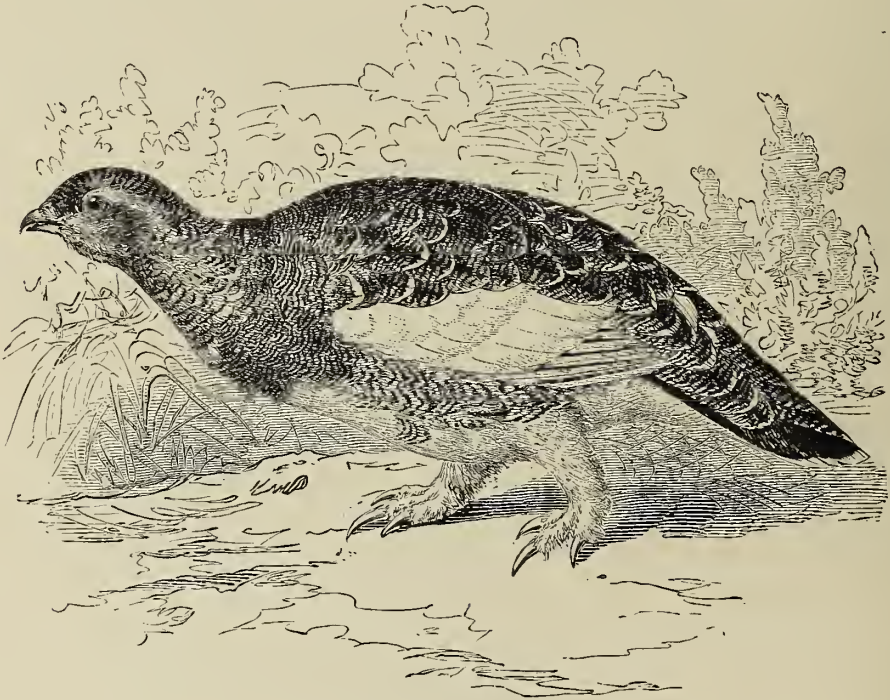
The Capercaillie was never a very common bird in England, and inhabited only the northern parts of Scotland, in which it gradually became extinct. About forty years ago, an attempt to re-introduce the bird was made by the Marquis of Breadalbane, with such success that in certain districts of Scotland the Capercaillie is now quite plentiful. Numbers of them are exposed for sale during the winter in the London shops, many of them, however, coming from Norway, where the species is common, and a capital account of its habits will be found in Mr. Lloyd's "Game-birds and Wild-fowl of Sweden and Norway." The nest of the Capercaillie is placed on the ground, and from six to twelve eggs are laid by the hen bird, who looks after the rearing of the young, without assistance from the cock. The young ones keep with their mother until the winter commences, the cock birds separating from her before the hens. In spring-time the male Capercaillie begins his *play*, as it is called, like many other Game-birds, for the purpose of attracting the hen birds. Seated on a pine, he starts his love-song, which is kept up the entire day from sunrise to sunset, and while thus engaged he becomes so absorbed in his efforts, that he falls an easy prey to the gunner, who is able to creep up within shooting distance. The same spot is used as a "playing-ground" by the male Capercaillie for a considerable time, if the bird is undisturbed, and several birds may be heard in the same locality at the same time. Fights often take place between the males, and the old birds never allow the young cocks of the preceding year to play on their domain. The cry of the male resembles the words *pellor, pellor, pellor*, increasing in rapidity; and this is replied to by the females within hearing by a sort of harsh croak resembling the words *goet, goet, goet*. While uttering his notes, the cock bird puffs out his plumage and puts himself in extraordinary attitudes.

The length of the Capercaillie is about twenty-eight or thirty inches, the plumage is black, the nape and hind neck deep grey with blackish wavy lines. The under parts are spotted with white, and there is a steel-green shade in the breast: tail black, with white spots. The female is smaller, and is of a sandy-brown colour, barred and variegated with black.

The Black Cock (*Tetrao*, or *Lyrurus tetrix*) is also found only in the Palearctic region. It is widely spread over Europe, but is replaced in the Caucasus by another species—the Georgian Black Grouse. The beautiful curved outer tail-feathers always serve to distinguish the Black game from the Capercaillie. The Hazel Grouse (*Bonasia betulina*) is another European Grouse, which, however, does not come to England, but is found over Northern Europe and North Asia, and is a pretty bird with a fine crest.

The Ptarmigan (*Lagopus mutus*) is found on the high mountains of Scotland, and throughout the mountainous parts of Europe, but does not occur in America. The present species, according to Dr. Dresser, "inhabits the more elevated, rocky, and barren localities, where it replaces the Scottish Grouse and the Willow Grouse, and it seldom or never descends to the lowlands, where these latter species have their home, unless driven down by stress of weather in search after food. The tracts of ground over which the Ptarmigan is distributed are much more extensive and more inaccessible than those

lowland ranges which the Red Grouse and Willow Grouse frequent ; and hence the present species appears somewhat less numerous than the latter bird. Should an intruder make his appearance in the home of the Ptarmigan, or should a bird of prey appear, they squat and remain motionless, trusting chiefly to the similarity of their plumage to the ground and the herbage to enable them to escape unseen. Should one utter his croaking note, he is generally on a stone ready to take wing at a moment's notice, and when he rises and calls all the rest of the covey join him. So close do they squat, and so well does their plumage harmonise at all seasons of the year with the surroundings, that one may walk through a covey without being aware of the close proximity of a single individual. In the month of July, according to Macgillivray, and in October, according to Barth and other Scandinavian naturalists, the Ptarmigans begin to collect in packs, and are found in lower altitudes than in



THE PTARMIGAN, IN SUMMER PLUMAGE.

the summer season. Barth says they do not unfrequently visit the sea-coast, and, being white, are very conspicuous ; they appear quite bewildered, and easy to approach within gunshot, whereas, when the ground is covered with snow, they are shy and take wing before one has arrived within anything like gunshot range. They fly tolerably swiftly, in a loose irregular body, their mode of flight resembling that of the Red Grouse, and when once on the wing, will generally fly some distance before settling. Their call note is a harsh croak, not unlike the croak of a frog, and it is frequently uttered as an alarm call. The food of the present species consists chiefly of the tender twigs and leaves of *Empetrum nigrum* ; but Macgillivray says that the crops of specimens he examined contained a large quantity of fresh green twigs of *Calluna vulgaris*, *Vaccinium myrtillus*, and *Empetrum nigrum*, the largest fragments not exceeding five-twelfths of an inch in length. Leaves and twigs of *Vaccinium vitis-Idæa*, *Salix herbacea*, seeds of various *Juncea* and *Cyperaceæ*, and other plants, with berries in autumn, also form part of their food, the same as that of the Red Grouse. The Grey Ptarmigan, then, is a bird which, feeding on vegetable substances, containing comparatively little nourishment, introduces a large quantity at a time, like a ruminating quadruped, and gradually digests it while reposing."

In summer the Ptarmigan puts off his white dress and becomes dark-coloured, not unlike a Willow

Grouse, so that its plumage, assimilating to the colour-tints of the country which it inhabits, proves a protection to the bird. In autumn, however, when the abundance of mosses and lichens gives a grey appearance to the country, the dark-plumaged Ptarmigan would be a conspicuous object; but here again a protective resemblance occurs in the plumage, which in the autumn partakes of an ashy grey shade. In winter, also, when the snow covers the ground, even the Ptarmigan in his autumn livery would be easily seen, and therefore one can understand how great a protection the snow-white plumage of the bird must be, enabling it to hide itself in the kindred snow, and so escape the prying eyes of Hawks, which would soon pounce down on it.



THE PTARMIGAN, IN WINTER PLUMAGE.

The Willow Grouse (*Lagopus albus*) is very similar in plumage to the Ptarmigan, and, like that species, is white in winter, and darker plumaged in summer. It inhabits Scandinavia, and stretches not only throughout Northern Europe and Siberia, but even extends across the northern part of the New World. In England it is represented by the Red Grouse, which, however, does not put on a white winter dress. The following particulars about the habits of the Willow Grouse are derived from a paper by Mr. Barth on the subject:—The present species is found only where the birch tree is abundant; and plains where only the dwarf birch and willow are found are not suitable to it, as it cannot live in localities where the cover is poor, but requires birch thickets; thus it is rare or common according as the birch growth is distributed. Tracts where larger birch woods and birch thickets are found alternately, with juniper scattered here and there, are its favourite haunts; for there it finds good cover during the seasons when it is changing its plumage. The female deposits from eight to eighteen and even twenty eggs, early or late, according to the elevation inhabited by the bird. Mr. Barth found newly-hatched young in July, and eggs as late as the middle of August. The young birds can

fly when eight days old, at which age they are about as large as a Lark. The parent bird tends them with the greatest care, and when surprised with them will not desert them, but may often be approached near enough to be knocked down with a stick. When about four weeks old the young are as large as a Plover, and are then considered old enough to be shot. They lie very close, and scatter after being flushed, and are then easily procured with the aid of a good dog. In August they grow very quickly, and by the end of the month they are full grown. It appears that when small they not unfrequently lose their parents, but are then taken care of by others; and often as many as thirty individuals of various ages are found in one covey. Until late in September, the coveys remain in the localities where they have bred, and can be approached; but later than that, they pack and resort to the mountains, and gradually get into regions where the true growth ceases. They are then unapproachable, and a quick shot only can get an odd bird out of a pack of about five hundred. Mr. Barth speaks of a pack of about three thousand individuals which he saw between the 3rd and 10th of November. Curiously enough they are sometimes much less shy than at others; and Mr. Barth cannot account for this, except that the weather may to some extent be the cause. He remarks that during the winter they not unfrequently feed at night, and from the middle of March to the middle of April they are to be found in the morning and afternoon in the tops of the birches feeding on the buds. About the middle of March they pair, and commence to drum when in packs of several hundred individuals, but some scatter to their respective breeding haunts, where they live in pairs. The males, however, are more numerous than the females, those which remain unmated ranging about in flocks; and Mr. Barth met with one of about forty individuals on a small island, and shot fifteen out of them, it being considered quite correct to shoot these even during the breeding season.

THE SECOND SUB-FAMILY OF THE TETRAONIDÆ—THE PARTRIDGES (*Perdiciinæ*).

All the Partridges have the legs bare and the nostrils naked, with a small operculum, or horny skin, on the upper margin. They are found nearly all over the world, the Pacific Islands alone not possessing any member of the sub-family. In Africa and in India the Francolins constitute one representative of the Partridges; and one species, the common Black Francolin (*Francolinus vulgaris*), is found in Asia Minor and other countries of the Mediterranean basin, extending across Persia to India. The Francolin is a very handsome bird, and, although banished from Sicily, it is by no means uncommon in Cyprus, and still more so in Palestine and Asia Minor.

In America, the Partridges are called Odontophores, or, more familiarly, American Partridges, and they are distinguished by the notches in the mandibles of the bill; the latter also is higher, and more arched than in the Old World species. The following note on one of the largest of the Odontophores is given by that excellent observer, Prince Maximilian, of Neuwied:—"It is called 'Capueira' by the Brazilians. Its habits and mode of life are very similar to those of the Hazel Grouse or Gelinotte of Europe (*Bonasia betulina*). It never frequents the open country, but confines itself entirely to the thick woods. In the early part of the year the Capueira lives in pairs, and after the breeding season the families remain in coveys of from ten to sixteen or more in number. These birds run very quickly, and procure their food among the dry leaves on the ground in the midst of extensive woods. The stomachs of such as I examined contained fruits, berries, insects, small stones, and a little sand. The part of the country in which I met with them is the eastern portion of Southern Brazil, from Rio de Janeiro to 13° S. lat.; by Spix they appear to have been found still farther north. In the vast forests bordering the rivers Mucuri, Alcobaça, Belmonte, and Ilheo, they were very common, and we frequently killed them for the sake of the flesh, which was excellent. Their loud and remarkable voice is heard only in the forests, where it reverberates to a great distance. Azara states that the cry is uttered by both sexes, but I believe it is emitted by the male only. Like the domestic cock in Europe, it frequently aroused us at the break of day, bidding us, as it were, continue our researches among the grand, but almost impenetrable, forests of that country. They commenced calling before daybreak, thus affording us ample time for breakfasting, and enabling us to start by the dawn of the young day."

Some of the American Partridges are familiar to us in this country, such as the Virginian Quail (*Ortyx virginianus*) and the Californian Quail (*Lophortyx californianus*), attempts having been made, on more than one occasion, to introduce these birds as game into England; while

they are to be seen alive in most of the Zoological Gardens of Europe. The Californian Quail is not only remarkable for the beautiful crest which adorns the head, but also for the rich admixture of colour in its plumage. It is very plentiful in California, being found, according to Dr. Gambel, in swarms, which inhabit not only the woods, but also bushy plains and hill-sides, these flocks sometimes numbering a thousand individuals. As many as fifteen eggs are laid, and the same observer once found twenty-four in a nest, which he supposed to have been the produce of two hen birds. The nest is placed on the ground, usually beneath a bush or at the foot of a tree, the eggs being placed in a hollow, and generally covered with a few leaves or a little dried grass.



THE CALIFORNIAN QUAIL.

The Common Partridge (*Perdix cinerea*) is widely spread over Europe, being replaced in Eastern Siberia by the Bearded Partridge (*Perdix barbata*). Unlike the Pheasants or the woodland-loving Grouse, the Partridge prefers the open ground, and runs, thereby, considerable risk in the rearing of its brood, should the season be wet and unfavourable to the little ones; hence it arises that the plenty or scarcity of this game-bird depends greatly upon the summer during which the nesting has been in progress. The eggs are often placed in a very exposed situation, and a considerable number of young birds are never hatched, owing to the accidents which overtake the sitting bird during the season of incubation at the jaws of a prowling fox or cat. Any apparent carelessness, however, on the part of the bird as regards her eggs, is amply compensated by the care and courage with which the old bird defends the brood if raised successfully. A nestling Partridge is a beautiful little creature, and has a knack of concealing its small body in the grass in such a successful manner, that if once the observer takes his eye off the bird, he will have great difficulty in re-discovering the object of his search. If suddenly startled off her nest, the old bird will feign lameness, or drop as if wounded, while her warning croaks as she flies off are probably a signal to the chicks to conceal themselves. When once able to fly, the young keep with the old birds in coveys, and evince great

affection for particular spots of ground, so that in shooting Partridges it often happens that a covey, when disturbed, will fly to an adjoining field, and being roused a second time from their retreat, will fly back again to their original starting-point; and this manœuvre the writer has seen repeated more than once by the same covey, until the continued havoc caused by the guns would force the survivors to fly farther away for safety's sake. So closely does the plumage of the Partridge assimilate to the stubble on the ground, that it is an impossibility to see the birds as they sit; and the first intimation of their presence is generally the "whirr" of the rising bird, as he betakes himself, with a croaking chuckle, to a safer retreat. The Partridge is a useful bird to the farmer,



THE COMMON PARTRIDGE.

feeding on slugs to a large extent, caterpillars, and grubs, so as entirely to counterbalance any little injury that it may do to the corn-fields.

The finest representatives of the Partridge are, undoubtedly, the Snow Cocks or Snow Partridges, which are found in the mountains of Asia Minor, the Caucasus, Altai Mountains, and the Himalayas, and high ranges of Tibet. The following account of the habits of the Himalayan Snow Partridge (*Tetrao gallus himalayensis*) is from the pen of Mr. Wilson, better known as "Mountaineer":—

"It is confined exclusively to the snowy ranges, or the large spurs jutting from them, which are elevated above the limits of forest, but is driven by the snows of winter to perform one, and, in some places, two annual migrations to the middle regions. In summer they are only seen near the limits of vegetation. In Koonour (Kunawur) they are common at all seasons, from Chuneé upwards; but on the Gangetic Hills, from June till August, however much a person wanders about on the highest accessible places, but few are met with, and I have no doubt whatever but that

nearly all which at other seasons frequent this part, retire across the snow into Chinese Tartary to breed. About the beginning of September they are first seen near the tops of the higher grassy ridges jutting from the snow and the green slopes above and about the limits of the forest. After the first general and severe fall of snow they come down in numbers on to some of the bare exposed hills in the forest regions, and remain there till the end of March. This partial migration is probably made in the night after the fall of snow, as I have invariably found them in their winter quarters early the next morning. It requires a deep fall to drive them down, and in some mild winters, except a few odd birds, they do not come at all. The birds on each respective hill seem to have a particular spot for their winter resort, to which they return every year the migration is made.

"The Snow Partridge is gregarious, congregating in packs, sometimes to the number of twenty or thirty, but in general not more than five to ten, several packs inhabiting the same hill. In summer the few which remain on our side are found in single pairs generally, but across the snow, when the great body migrate, I almost always, even then, found several together. They seldom leave the hill on which they are located, but fly backwards and forwards when disturbed. The Ring-tailed Eagle is an inveterate annoyer of these birds. Inhabiting such exposed situations, where there is nothing to conceal so large a bird from his sight as he sails along the hill-side above them, they at once arrest his attention, and are driven backwards and forwards by this unrelenting tormentor, all day long. On the appearance of one of these birds—which, fortunately for them, are not very numerous—they seldom wait till he makes a swoop, but on his making a wheel near the spot where they are, immediately fly off to another quarter on the hill. The Eagle never flies after or attacks them on the wing; so that, though he allows them little quietude while near their resort, he only occasionally succeeds in securing one.

"The Jer-Moonal never enters forest or jungle, and avoids spots where the grass is long, or where there is underwood of any kind. It is needless to add that it never perches. During the day, if the weather be fine and warm, they sit on the rocks or rugged parts of the hill, without moving much about, except in the morning and evening. When cold and cloudy, and in rainy weather, they are very brisk, and are moving about and feeding all day long. When feeding they walk slowly up-hill, picking up the tender blades of grass and young shoots of plants, occasionally stopping to snatch up a certain bulbous root of which they seem very fond. If they reach the summit of the hill, after remaining stationary some time, they fly off to another quarter, alighting some distance down, and again picking their way upwards. When walking they erect their tails, have a rather ungainly gait, and at a little distance have something the appearance of a large grey goose. They are partial to feeding on spots where the sheep have been kept at nights when grazing in the summer pastures. These places have been called 'tatters' by the shepherds, and the grass on them keeps green and fresh long after the rest of the hill is quite dry and brown. They roost on the rocks and shelves of precipices, and return to one spot many successive nights.

"The Jer-Moonal is not remarkably wild or shy. When approached from below, on a person getting within eighty or a hundred yards, it moves slowly up-hill or slanting across, often turning to look back, and does not go very far unless followed. If approached from above, it flies off at once, without walking many yards from the spot. It seldom in any situation walks far down hill, and never runs, except for a few yards when about to take wing. The whole flock get up together; the flight is rapid, downwards at first, and then curving so as to alight nearly on the same level. Where the hill is open and of great extent, it is often for upwards of a mile, at a considerable height in the air; when more circumscribed, as is often the case on the hills they frequent in the winter, it is of shorter duration—perhaps merely across or into the next ridge.

"They feed on the leaves of plants and grass, and occasionally on moss, roots, and flowers—grass forms by far the greater portion. They are very partial to the young blades of wheat and barley when it is first springing up, and while it remains short; and should there be an isolated patch on the hill where they are, visit it regularly night and morning. They never, however, come into what may be called the regular cultivation. They are generally exorbitantly fat, but the flesh is not particularly good, and it has often an unpleasant flavour when the bird is killed at a high elevation, probably owing to some of the plants it there feeds upon. Though I have spent many

summers on the snowy ranges, I never found the nest or eggs, but in Tibet I often met with broods of young ones newly hatched. There were, however, several old birds, and probably more than one brood of chicks, so I could form no correct idea of the number in one brood. They are hardy birds, and easily kept in confinement, but though they will eat grain, I doubt if they would live long without an occasional supply of their natural green food of grass and plants. They may be kept with the least trouble in large cages, the bottoms of which, instead of being solid, are made of bars of wood or iron wire, so that the cages being put out on the grass, the birds may feed through the interstices.

"The eggs which have been found by travellers are about the size of those of the Turkey, but, like those of the Grouse, are of a more lengthened form; their ground-colour clear light olive, sparingly dotted over with small light chestnut spots."

THE QUAIL.

The Quails are the smallest of the Partridge family, and are inhabitants of the Old World only; they are, however, widely distributed in all four regions. The species best known is the Common Quail (*Coturnix dactylisonans*), which visits Europe in the summer, when prodigious numbers are



THE PARTRIDGE AND THE COMMON QUAIL.

trapped and sold for purposes of food. Waterton mentions the fact of 17,000 specimens being brought to Rome in one day. They are to be found in large quantities on the coast of the Mediterranean, and so abundant are they in the beautiful island of Capri, that it is said from this source the bishops, in olden times, derived a large part of their wealth. The Quail is most rapid in its flight, and performs long and fatiguing journeys. Sunset is the time for active exertions; during the day they remain quite quiet, reserving their energies for the evening, when off they go in quest of food. Their favourite nourishment is insects, but they feed at times on grain and seeds; small stones are also swallowed to facilitate digestion. The habits of the Quail are most unamiable and unsocial, and generally when they meet with one of their own species they display a very pugnacious disposition. The female has a much better nature; she is a most excellent mother, even protecting young birds who have been deprived of their parents' care. She builds her own nest of small portions of plants, and lays eight to fourteen eggs; these are pear-shaped in form, of a light brown colour marked with a darker shade. The young are full-grown at six weeks old, and are ready to join their parents in their long autumn journey, which extends as far as the Cape of Good Hope, where they arrive in very large numbers.

The Quail, unlike the Partridge, has several wives, and displays great spirit in keeping rivals at a distance; while the mother is attending to her young ones, the male amuses himself in the vicinity with his companions. The flesh of this bird is esteemed a great delicacy, and the inhabitants of the warm climates, which are periodically visited by the Quail, look forward to its arrival with anxiety.

The length of the Quail is about seven inches and a half, and the general colour is brown, varied with buff streaks on the upper surface. The throat is reddish, and above the eye a buffy-white line passes along the sides of the crown and down the sides of the neck across the throat; the under surface is buffy. In the female the colours are not so bright, and the reddish colour on the throat is absent.

THE SIXTH FAMILY OF THE GAME BIRDS.—THE SAND GROUSE (*Pteroclidæ*).

The Sand Grouse are a group of birds which bear considerable relations to the Pigeons, and in India are often called "Rock Pigeons" by the English sportsman. They are inhabitants of desert countries as a rule, being found over Africa, in Madagascar, the Mediterranean region, Central Asia, and in the Indian Peninsula. Their favourite haunts are desert, open plains, and bare fields with no traces of cultivation; they live generally in large packs, and are rather shy, being quickly on the alert, and evading capture in a most clever manner. They find a valuable aid in their plumage, which is nearly the exact shade of the ground on which they rest, and which renders them almost invisible to the hunter. They squat down at his approach, and when he seems coming too close, fly off at an immense pace. Their flight is very rapid, and they make a peculiar sound with their wings. Their habits seem very regular in the manner of feeding, and morning, noon, and evening, large quantities assemble to drink at the rivers or tanks of water, and the sportsman can quite count on seeing thousands if he should come at one particular time. Their food consists of hard seeds, as well as little insects, &c., which they procure in the same way as the Pigeons or Partridges. Although the Sand Grouse live in such large companies, they are not polygamists; they, however, have frequent battles with their own species, particularly at the breeding season. This season varies according to locality: in the Deccan and Southern India it takes place from December to May; in Central India, later still; and in North Africa, at our usual spring-time. The female lays in a small hollow scraped in the sand, in which she deposits three or four eggs, which are of a greenish stone-colour, spotted closely with grey and brown. The male bird assists in attending to the wants of the little ones, and when arrived at maturity, all fly off together. It is quite possible to keep the Sand Grouse in captivity, and they are a great ornament to the aviary. Their flesh is good eating, if kept long enough; at first it is rather hard and tough, but that of the young birds is delicious, and is much prized. Their habit of squatting in close proximity to one another leads to the sportsman frequently bagging a number of specimens, should he be so fortunate as to creep up within shooting distance.

THE SEVENTH FAMILY OF THE GAME BIRDS.—THE HEMIPODES (*Turnicidæ*).

These are some of the smallest Game-birds known, many of the species not being as much as six inches long. They are found in Africa, India, the Malayan region, extending to China, and

Australia, while one of them, the Andalusian Hemipode, which is an inhabitant of Southern Europe, has even occurred in this country. They are easily distinguished, by the absence of a hind toe, from the smaller Quails of the genera *Coturnix* and *Excalfactoria*. Writing of the Black-breasted Bustard Quail (*Turnix tuijoo*), Dr. Jerdon observes that in India it "affects grassy patches in the forests and jungles, also low bushy jungle, and is frequently to be found in the fields of Chili and Dhal, and in various dense crops, especially if near patches of jungle; for in open or barren country, or very highly-cultivated country without jungle, it is comparatively rare. Occasionally small bevvies of five or six are flushed together, but in general it is put up singly, or two or three birds together. It feeds on grain of various kinds, but also very much on small insects, larvæ of grasshoppers, and the like. The female has a peculiar loud purring noise. The hen birds are most pugnacious, especially about the breeding season, and this propensity is made use of, in the South of India, to effect their capture. For this purpose a small cage with a decoy-bird is used, having a concealed spring compartment, made to fall by the snapping of a thread placed between the bars of the cage. It is set on the ground in some thick cover, carefully protected. The decoy-bird begins her loud purring call, which can be heard a long way off, and any females within earshot run rapidly to the spot, and commence fighting with the caged bird, striking at the bars. This soon breaks the thread, the spring-cover falls, ringing at the same time a small bell, by which the owner, who remains concealed near at hand, is warned of a capture, and he runs up, secures his prey, and sets the cage again in another locality. In this way I have known from twelve to twenty birds occasionally captured in one day, in a patch of thick bushy jungle in the Carnatic, where alone I have known this practice carried on. The birds that are caught in this way are all females, and in most cases are birds laying eggs at the time, for I have frequently known instances of some eight or ten of those captured so far advanced in the process as to lay their eggs in the bag in which they are carried before the bird-catcher had reached my house. The eggs are said to be usually deposited under a bush in a slight well-concealed hollow; they are from five to eight in number, and of a dull stone-grey, or green colour, thickly spotted and freckled with dusky spots, very large for the bird, and very blunt. In the Carnatic this bird breeds from July to September; farther south from June to August, and in Ceylon, says Layard, from February to August. The females are said by the natives to desert their eggs, and to associate together in flocks, and the males are said to be employed in hatching the eggs, but I can neither confirm nor reject this from my own observation." *

THE EIGHTH FAMILY OF THE GAME BIRDS.—THE MEGAPODES (*Megapodidae*).

The name Megapode is derived from two Greek words, signifying that the birds have large feet; and in proportion to the size of the bird the foot is, indeed, very big and powerful, being employed for scratching together the earth and rubbish, in heaps of which the eggs are deposited by the Megapode. The members of the family are distributed over Australia, the Papuan Islands, extending throughout the Moluccas and Celebes to Borneo and the Philippines, while an outlying species is found to inhabit the Nicobars. The largest of them all are the Brush-Turkeys (*Talegallus*) of Australia and New Guinea, the Australian species (*T. lathamii*) having been acclimated in Europe, so that in the Zoological Gardens the birds may not only be seen in a state of nature, but there are generally one or two of their mounds to be seen also. The members of the genus *Talegallus* have wattled skin on the head and neck, whence their supposed resemblance to a Turkey has gained for them the familiar name of *Brush-Turkey* from the Australian settlers. As a rule, the colouring of the Megapodes is sombre, being generally brown or black, the only exception being the Maleo bird of Celebes, which has a curious knob on the head, while the breast is light-pink in colour. Of this bird Mr. Wallace gives the following interesting account:—

"In the months of August and September, when there is little or no rain, the Maleos come down in pairs from the interior to one or two favourite spots, and scratch holes three or four feet deep, just above high-water mark, where the female deposits a single large egg, which she covers with about a foot of sand, and then returns to the forest. At the end of ten or twelve days she comes again to the same spot to lay another egg, and each female bird is supposed to lay six or eight eggs during the season. The

* "Birds of India," Vol. II., p. 597.



THE MALEO.

AUSTRALIAN MEGAPODE.

BRUSH TURKEY.

male assists the female in making the hole, coming down and returning with her. The appearance of these birds when walking on the beach is very handsome. The glossy black and rosy white of the plumage, the helmeted head, and elevated tail, like that of the common fowl, give a striking character, which their stately and somewhat sedate walk renders still more remarkable. There is hardly any difference between the sexes, except that the casque or bonnet at the back of the head, and the tubercles at the nostrils, are a little larger, while the beautiful rosy salmon-colour is perhaps deeper in the male bird; but the difference is so slight that it is not always possible to tell a male from a female without dissection. They run quickly, but when shot at or suddenly disturbed take wing with a heavy noisy flight to some neighbouring tree, where they settle on a low branch; they probably roost at night in a similar situation. Many females lay in the same hole, for a dozen eggs are often found together, and these are so large that it is not possible for the body of the bird to contain more than one fully-developed egg at the same time. In all the female birds which I shot," continues this author, "none of the eggs besides the one large one exceeded the size of peas, and there were only eight or nine of these, which is possibly the extreme number a bird can lay in the season.

"Arrived at our destination, we built a hut, and prepared for a stay of some days, I to shoot and skin Maleos. The place is situated in the large bay between the islands of Limbé and Banca, and consists of a steep beach more than a mile in length, of deep, loose, and coarse black volcanic sand, or rather gravel, very fatiguing to walk over. It is in this loose black sand that those singular birds, the Maleos, deposit their egg.

"Every year the natives come for fifty miles round to obtain these eggs, which are esteemed a great delicacy, and when quite fresh are indeed delicious. They are richer than hens' eggs, and of a fine flavour; each one completely fills an ordinary tea-cup, and forms, with bread or rice, a very good meal. The colour of the shell is a pale brick-red, or very rarely pure white. They are elongate, and very slightly smaller at one end, from four to four and a half inches long, by two and a quarter and two and a half wide."

After the eggs are deposited in the sand they are no longer cared for by the mother. The young birds, on breaking the shell, work their way up through the sand, and run off at once to the forest. "I was assured by Mr. Duivenboden, of Ternate," says Wallace, "that they can fly the very day they are hatched. He had taken some eggs on board his schooner which were hatched during the night, and in the morning the little birds flew readily across the cabin. Considering the great distances the hens come to deposit the eggs in a proper situation (often ten or fifteen miles), it seems extraordinary that they should take no further care of them. It is, however, quite certain that they neither do nor can watch them. The eggs being deposited by a number of hens in succession in the same hole would render it impossible for each to distinguish its own, and the food necessary for such large birds, consisting entirely of fallen fruits, can only be obtained by roaming over an extensive district; so that if the numbers which come down to this single beach in the breeding season, amounting to many hundreds, were obliged to remain in the vicinity, many would perish of hunger." Dr. Meyer says that the native name of this bird in Celebes is not Maleo, but Moleo.

Of a true *Megapodius* we have a good example in Cuming's Megapode (*Megapodius cumingi*), from North-western Borneo, and the following history of the species is given by Mr. Motley in his "Natural History of Labuan." He writes:—

"In Labuan they are not uncommon, and are said to be principally confined to small islands, to such, more especially, as have sandy beaches. They are very rarely to be seen, being extremely shy, and frequenting dense and flat parts of the jungle, where the ratans grow, and where the luxuriance of the vegetation renders concealment easy. The Malays snare them by forming long, thick fences in unfrequented parts of the jungle, in which, at certain intervals, they leave openings where they place traps. The birds run through the jungle in search of food, and coming to this fence, run along it till they find one of the openings, through which they push their way, and are caught in the trap. In walking they lift up their feet very high, and set up their backs something like Guinea Fowls; they frequently make a loud noise like the screech of a chicken when caught; they are very pugnacious, and fight with great fury by jumping upon one another's backs, and scratching with their long, strong claws. Their food principally consists of seeds and insects. The eggs are of a fine dark cream colour, and of a very large size, three of them weighing nearly as much as a full-grown bird. Accord-



BRUSH-TURKEYS AT WORK.

ing to the account given by the Malays, each bird lays about eight or ten eggs at each time of breeding, and their nests are merely large heaps of shells and rubbish deposited over the sandy soil in which the eggs are buried to the depth of about eighteen inches. Since receiving this account, however, we have had an opportunity of inspecting a very large and perfect nest, or breeding-hill, and found it to be about twenty feet in diameter, and composed of sand, earth, and sticks; it was close to the beach, just within the jungle, and scarcely above high-water mark, and appeared to have been used for many years. The boatmen seemed to have no clue to what part of the hillock contained eggs, but said they were never without some when frequented at all. They sought for nearly a half an hour in vain before they found one, and then they got about a dozen together; they were buried at a depth of from one to three feet, in an upright position, and the ground about them was astonishingly hard. The eggs thus deposited are left to be hatched by the heat of the sun, and this, the Malays assert, requires between three and four months to complete. Those obtained from this heap were brought home and buried in a box of sand, and a month or two afterwards it was discovered that they had all hatched, but that from neglecting to place them in a proper (*i.e.*, probably an upright) position, the chicks could not get up through the sand, and had all perished. When hatched, the chicks are almost entirely fledged; even the long quills being, as the Malay says, 'needled.' When first dug out, some of the eggs had lost much of their outer colour, which appeared to have scaled off, leaving only a white chalky shell. On a former occasion some eggs were brought by the natives, and were buried in a box of sand, and exposed to the weather: at the end of about three weeks one of the chicks was hatched. A Malay, who saw it emerge, said that it just shook off the sand and ran away so fast that it was with difficulty caught; it then appeared to be nearly half-grown, and from the first fed itself without hesitation, scratching and turning up the sand like an old bird. Two more afterwards emerged in the same state. Their eggs are held in such high estimation as food, both by natives and Europeans, that one cannot but fear that these interesting birds, though now so abundant, will ere long become scarce."

The late Mr. Gilbert Gould also describes the habits of the Mound-raising Megapode of Australia in a minute and exhaustive manner. The particulars which he furnishes about the mounds are very interesting:—

"I revisited Knocker's Bay on the 10th of February, and having with some difficulty penetrated into a dense thicket of cane-like creeping plants, I suddenly found myself beside a mound of gigantic proportions. It was fifteen feet in height and sixty in circumference at the base, the upper part being about a third less, and was entirely composed of the richest description of light vegetable mould; on the top were very recent marks of birds' feet. The native and myself immediately set to work, and after an hour's extreme labour, rendered the more fatiguing from the excessive heat, and the tormenting attacks of myriads of mosquitoes and sand-flies, I succeeded in obtaining an egg from a depth of about five feet. It was in a perpendicular position with the earth surrounding and very lightly touching it on all sides, and without any other material to impart warmth, which, in fact, did not appear necessary, the mound being quite warm to the hands. The holes in this mound commenced at the outer edge of the summit, and ran down obliquely towards the centre; their direction was therefore uniform. Like the majority of the mounds I have seen, this was so enveloped in thickly foliaged trees as to preclude the possibility of the sun's rays reaching any part of it.

"The mounds differ very much in their composition, form, and situation; most of those that are placed near the water's edge were formed of sand and shells, without a vestige of any other material, but in some of them I met with a portion of soil and decaying wood. When constructed of this loose material they are very irregular in outline, and often resemble a bank thrown up by a constant surf. One remarkable specimen of this description, situated on the southern bank of Knocker's Bay, has the appearance of a bank from twenty-five to thirty feet in length, with an average height of five feet; another, even more singular, is situated at the head of the harbour, and is composed entirely of pebbly iron-stone, resembling a confused heap of sifted gravel; into this I dug to the depth of two or three feet without finding any change of character. It may have been conical originally, but is now without any regularity, and is very extensive, covering a space of at least a hundred and fifty feet in circumference. These remarkable specimens would, however, seem to be exceptions, as by far the greater number are entirely formed of light, black, vegetable soil, are of a conical form, and are situated in the densest thickets. Occasionally the mounds are met with in barren, rocky, and sandy situations, where not a

particle of soil similar to that of which they are composed occurs for miles round; how the soil is produced in such situations appears unaccountable. It has been said that the parent birds bring it from a great distance; but as, as we have seen, they readily adapt themselves to the difference of situation, this is scarcely probable. I conceive that they collect the dead leaves, and other vegetable matter that may be at hand, and which, decomposing, forms this particular description of soil. The mounds are doubtless the work of many years, and of many birds in succession; some of them are evidently very ancient, trees being often seen growing from their sides. In one instance I found a tree growing from the middle of a mound which was a foot in diameter. I endeavoured to glean from the natives how the young effect their escape; but on this point they do not agree, some asserting that they find their way unaided, others, on the contrary, affirmed that the old birds, knowing when the young are ready to emerge from their confinement, scratch down and release them.

"The natives say that only a single pair of birds are ever found at one mound at a time, and such, judging from my own observation, I believe to be the case. They also affirm that the eggs are deposited at night, at intervals of several days, and this I also believe to be correct, as four eggs, taken on the same day, and from the same mound, contained young in different stages of development; and the fact that they are always placed perpendicularly is established by the concurring testimony of all the different tribes of natives I have questioned on the subject.

"The Megapode is confined almost exclusively to the dense thickets immediately adjacent to the sea-beach; it appears never to go far inland except along the banks of creeks. It is always met with in pairs, or quite solitary, and feeds on the ground, its food consisting of roots, which its powerful claws, enable it to scratch up with the utmost facility, and also of seeds, berries, and insects, particularly the larger species of coleoptera. It is at all times a very difficult bird to procure; for although the rustling noise produced by its stiff pinions when flying may be frequently heard, the bird itself is seldom to be seen. Its flight is heavy and unsustained in the extreme. When first disturbed, it invariably flies to a tree, and on alighting stretches out its head and neck in a straight line with its body, remaining in this position as stationary and motionless as the branch upon which it is perched; if, however, it becomes fairly alarmed, it takes a horizontal but laborious flight for about a hundred yards, with its legs hanging down as if broken. I did not myself detect any note or cry, but from the natives' description and imitation of it, it much resembles the clucking of the domestic fowl, ending with a scream like a Peacock.

"I observed that the birds continued to lay from the latter part of August to March, when I left that part of the country; and, according to the testimony of the natives, there is only an interval of about four or five months, the driest and hottest part of the year, between their seasons of incubation. The composition of the mound appears to influence the colouring of a thin epidermis with which the eggs are covered, and which readily chips off, showing the true shell to be white. Those deposited in the black soil are always of a dark reddish-brown, while those from the sandy hillocks near the beach are of a dirty yellowish-white; they differ a good deal in size, but in form they all assimilate, both ends being equal. They are three inches and five lines long, by two inches and three lines broad."*

As to the very curious method of incubation adopted in the case of these Mound-birds, or Megapodidæ, the common supposition has been that these birds, with their large feet and long curved claws, raked together earth, dead leaves, rotten sticks, stones, and so on, till perhaps they formed a mound as much as six feet high and twelve feet long. This they frequently did in company, and the "incubator" thus formed was shared by a number, who laid their eggs in it, and left them to be hatched by the heat evolved by the decaying substances. Compare, however, with the above account the latest observations on the subject, namely, those of Mr. H. N. Moseley, F.R.S. He says, in his "Naturalist on the *Challenger*," that "the eggs [of Megapodius] were buried in the clean sand, at a depth of three-and-a-half or four feet, and with no mound over them, or vegetable rubbish of any kind. The eggs are thus hatched by the simple warmth of the sand received from the sun, and retained during the night, just in the same manner as turtle's eggs are hatched. . . . I had always supposed that these birds and their allies hatched their eggs by means of the heat derived from decayed vegetable matter."

* Gould's "Handbook to the Birds of Australia," Vol. II., p. 171.

CHAPTER VIII.

THE WADING BIRDS.

Chief Characters of a Wading Bird—General Habits—THE RAILS—Distinctive Features—THE JACANAS—Foot—Distribution—The Pheasant-tailed Jacana—THE TRUE RAILS AND CRAKES—Characteristics—The Water Rail—The Corn-crake, or Land Rail—THE WATER HENS—The Blue Water Hens—The Common Water Hen, or Moor Hen—Its Habits—Its Nest—Its Young—Its Bad Character—THE COOTS—Foot Characters—Appearance—Nest and Eggs—THE FINFOOTS—THE SNIPES—Distinctive Features—THE CURLEWS—Their Curved Bill—The Red-billed Curlew—The Painted Snipes—Anomaly about the Females—The Curlews—THE SANDPIPERS—The Collector's Quest—Summer Snipes—Terns—Godwits—Plover Acting as Sentinel—The Dunlin—The Curlew Sandpiper—The Knot—The Ruff—THE PHALAROPES—THE STILTS, OR STILT PLOVERS—The Avocet—The Stilts—THE PLOVERS—THE TURNSTONES—THE TRUE PLOVERS—The Lapwing, or "Pee-wit"—Mr. Seebohm's Account of the Habits of the Grey Plover—Golden Plovers—Sand Plovers—THE OYSTER-CATCHERS—THE BUSTARDS—Characters—The Thick-knee, or Stone Curlew—The Coursers—Dr. Brehm's Account of the Habits of the Great Bustard—THE CRANES—The Kagu—The Sun Bittern—THE COMMON CRANE—Stories of Von Seyffertitz's Tame Crane—THE TRUMPETERS.

THE SIXTH ORDER OF BIRDS.—THE WADING BIRDS (GRALLÆ).

THE principal character of a Wading-bird is the long leg, with the bend of the tarsal joint unfeathered, and the toes long and cleft nearly to the base. The head is small, and the bill in most of them long and narrow, the body compressed, the wing long, excepting in the case of the Rails. They can nearly all swim well, but as a rule do not do so, searching for their food by the reedy banks of rivers or on the sea-shore, and most of them are of shy or skulking habits. They are principally migratory birds, and include among their number some of the farthest-ranging species in the world. Most of the Waders breed in northern latitudes, many only within the Arctic Circle, and at the end of the nesting season they migrate, either singly or in flocks, down to the extreme south, both in America, Africa, and even to Australia and New Zealand.

In the birds which are here enumerated as *Grallæ* the nasal openings are large, placed low in the upper mandible, and are either surrounded or shut in by a rather broad soft skin. The bill varies greatly, but as a rule is narrow and compressed. None of the *Grallæ* are of very large size; and with the exception of the Rails, which generally construct a nest, the eggs are mostly placed on the bare ground. The young of all are able to shift for themselves almost the instant they are hatched.

THE FIRST FAMILY OF THE GRALLÆ, OR WADING BIRDS.—THE RAILS (*Rallidæ*).

Amongst the many long-winged species which form the majority of Wading-birds, the Rails stand out very conspicuously for their short wings, which are concave as well, and fit the body closely. This is a provision of nature wonderfully well adapted for the habits of the Rails, whose bodies are extremely thin and slender; enabling them to thread their way through the reeds in search of their food with the greatest ease. The skulking habits of most of them give an idea of their being bad flyers, but this is by no means the case, for most of them are migrants, and some of them take long voyages; the Corn-crake, for instance, nesting in Europe, and betaking itself to South Africa during our winter months; the Moor-hen and many of the European Crakes (*Ortygometra*) making the same long journey, though they are not so completely migratory from this country as the Corn-crake.

A Rail has rather a long hind toe, the forehead much flattened, and the fore part of the crown depressed, but it is principally by their compactly plumaged and thin body, and the long spider-like toes, that they are generally recognised. They feed on small insects, worms, seeds, and fragments of plants, while such larger-sized birds as the Moor-hen or Coot will eat eggs, and even kill chickens and carry them off.

The *Rallidæ* may be subdivided into five sections, which may be considered as sub-families.

THE FIRST SUB-FAMILY OF THE RALLIDÆ.—THE JACANAS (*Parrinæ*).

The form of the foot separates the five sub-families of the Rails, and the Jacanas are easily recognisable by the extremely long and straight claws, which render them totally unlike any other birds in this respect. They are inhabitants of warm climates only, being found in South America, Africa, India, and Australia. Many of them have a shield on the forehead, like the Coots and

Moor-hens, but they are more variegated in colour than either these birds or the rest of the Rails. The young birds, however, are not so handsomely coloured as the adults.

THE PHEASANT-TAILED JACANA (*Hydrophasianus chirurgus*).

This is the largest of all the Jacanas, and is a native of India and Ceylon, where it inhabits jheels, marshes, and reedy banks, but it is rather bolder in its habits than the other Indian species. Dr. Jerdon says that the breeding plumage is assumed very early, as he has seen some specimens with their summer dress and long tail in February, so that it is probable that some birds do not always put on a winter dress; as a rule, however, they do not change till May or June. According to the same observer, it makes a large floating nest of dried pieces of grass and herbage, sometimes, according to other accounts, of the stalks of growing rice, which it bends downwards and intertwines, and it lays in July and August from four to seven eggs, occasionally more, of a fine bronze brown or green. It has a loud call, likened by some to the mewing of a cat or a kitten in distress, by others to the distant cry of a hound; an imitation of the sound is attempted in the Hindustani names *Piho* and *Meewah*. The Cingalese also, according to Layard, call it *Cat-Teal*. Like the other Indian species, it feeds chiefly on vegetable matter, but also on shells and water insects. In Purneah the natives say that before the inundation, *i.e.*, before the breeding season, it calls *Dub, dub*—"Go under water;" and afterwards in the cold weather, *Powar*, which, in Purneah dialect, means "next year." In winter this species is gregarious. If only wounded it is difficult to find, as, like the English Moor-hen, it dives at once and remains with its bill only out of the water. The flesh is said to be excellent. Blyth states



THE JACANA.

that he has kept both the Indian Jacanas in confinement, and that they thrive well on shrimps, but the present bird was in the aviary rather quarrelsome with its kind.

THE SECOND SUB-FAMILY OF THE RALLIDÆ.—THE TRUE RAILS AND CRAKES (*Rallinæ*).

In this sub-family the claws are short, there is no frontal shield on the head, and the toes, though long, are simple and without any lobes. Many of them are of large size, such as the great *Aramus* of South America, or the Wood-hens (*Ocydromus*) of New Zealand. The latter cannot fly, though they are of the size of a barn-door fowl.

The most typical members of this sub-family are undoubtedly the Water Rails (*Rallus*) and the



THE CORN-CRAKE, OR LAND-RAIL.

Crakes (*Ortygometra*), both of which are represented in England, the former by one, the latter by several species. The Water Rail (*Rallus aquaticus*) may be easily told by its brown coloration and banded flanks, but particularly by its long bill, which exceeds the head in length, whereas in the Crakes this is not the case. The upper mandible and the tips of the lower one are blackish-brown, the rest of the latter reddish. In colour the bird is brown, streaked with black, less distinctly on the head; the quills and tail blackish-brown; lores and eyebrow, sides of face, and under parts slaty-grey; the abdomen and under tail-coverts ochre-colour; flanks black, banded across with white; the iris is red. The male measures about eleven inches in length; the female is smaller. The attenuation of the body may be gathered from the fact that, although nearly a foot in length, it is not three inches across the back, and hence the facility with which it threads its way through the reeds, scarcely ever rising, unless driven to do so by a dog; so that, although resident with us all the year in England, it is seldom seen. It is by means of keeping close in the marshes and bogs, which it affects, that it gains its best assurance of security, as it is by no means a good flyer, though it swims and dives with agility.

Its nest is placed on the ground, in close herbage or amongst reeds, and the number of eggs varies from six to ten. As with many of the Rallidæ, the chicks are nothing more than little balls of fluffy black down when first hatched, but on the least alarm they take to the water, and conceal themselves with much adroitness in the adjoining rushes or grass.

The Corn-crake, or Land Rail (*Ortygometra crex*), is a summer visitor to England, and speedily makes known its arrival by its call, which may be heard resounding throughout the night, and even in the daytime. Its cry is very harsh, and may be imitated by rubbing a bit of wood sharply along the teeth of a comb; it is uttered by the male bird only, and is heard more on its first arrival, ceasing almost entirely when the young are hatched, as is the case with so many other birds. As a rule, the haunts of this species are confined to fields of long grass or corn, and oftentimes the nest is mowed out when the hay is cut, the scythe not unfrequently decapitating the faithful mother, who sits very close, and has been known even to carry away her nestlings out of reach of danger. It does not, like its cousin the Water Rail, frequent marshes or wet ground, though it is often found in hay-fields close to rivers, and it can swim with vigour when forced to do so. A companion was walking one evening with the writer by the banks of the Thames when the cry of a Land Rail was heard at a short distance off, and after some trouble was driven to take wing, when a well-directed throw of a walking-stick brought it to the ground, within a few feet of the river-bank. It lay apparently dead, but on being approached it suddenly sprang up, and without any hesitation plunged over a steep bank into the river, and notwithstanding a broken wing, it managed to cross at a place where the river was not less than seventy yards broad. The bill in the Land Rail is much stouter than in the Water Rail, not exceeding the head in length, and the general colour is more of a reddish-brown. In the autumn the old birds depart with their families, migrating in silence and concealment for their winter home, which is the continent of Africa, where the species passes down the Nile Valley as far as the Cape Colony. In September the Land Rail is often met with in the clover and turnip-fields, and we have known as many as eight to be killed in a single day when out Partridge-shooting. The flesh is very good for the table. The young are covered with black down when first hatched, and moult before migrating.

The other members of the sub-family Rallinæ are very numerous, and are distributed over the entire globe.

THE THIRD SUB-FAMILY OF THE RALLIDÆ.—THE WATER-HENS (*Gallinulinae*).

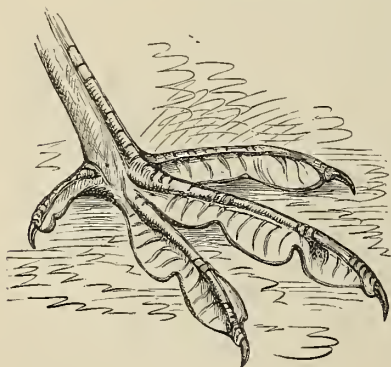
In this sub-family occur the brightest plumaged of the Rails, viz., the Blue Water-hens (*Porphyrio*), the members of this genus being found everywhere, excepting the northern parts of the Old and New Worlds. They very much resemble our English Water-hen, or Moor-hen, in their habits, but are much larger and more stately-looking birds, while in flight their beautiful blue plumage shows to advantage; they also have a very large red frontal shield.

THE COMMON WATER-HEN, OR MOOR-HEN (*Gallinula chloropus*).

Passing a large pond or sheet of water in a railway-carriage, the observer may often see a small black bird swimming near the edge of the reeds, or flying out of danger with a flapping of the wings that leaves a long trail of disturbed water behind it to mark its flight. This will be either a Moor-hen or a Coot; but even at some distance the two species can be easily recognised, the ivory white shield on the forehead of the latter being always very conspicuous. The frontal shield of a Water-hen is red, and from being much smaller is not so easily seen. With the exceptional case of Mr. Waterton, who managed by protection to make wild birds tame, the Coot is much more shy in its nature than the Moor-hen, and does not so often become fearless and confiding like the latter bird. When unmolested the Moor-hen will often quit his native pond or lake and be allured to the lawn or neighbourhood of the house, coming regularly for its food. The writer, indeed, remembers having visited a gardener's cottage, in Leicestershire, where a pair of Moor-hens came from a neighbouring pond at the call of the old woman who lived in the little house, and not only fed themselves within a few yards of the spectators, but even brought their young brood to share the repast afforded by their kind protector. Skirting the lake in a boat, one is first made aware of the presence of a Moor-hen by the warning croak which is heard from the reeds some distance ahead, for the bird is fully conscious of danger, and long ere the boat approaches may be seen swimming rapidly to the shore from the middle of the lake

towards the friendly reeds which skirt its edge. Here it will be difficult to flush the birds without the aid of a dog, but carefully proceeding along the margin of the rushes, the naturalist will probably be gratified by the "sough" of a body falling into the water, and will find, close by, the nest, raised a little above the water, and concealed from the bank by a mass of intervening reeds. Many yards off the bird will itself emerge and betake itself, with flapping wings, and legs hanging down, to the opposite side of the lake, although we have known the hen bird, if the eggs are hard-set or the young newly-hatched, to stay in the vicinity of the nest and croak as if in anger, or more probably in the latter case to encourage the young birds with her presence. The nest is large and rather flat, composed of dead rushes, and perfectly warm and dry, the chicks when hatched being merely tiny balls of black down with pretty little red heads. They utter a "cheeping" note, which may be often heard inside the egg, before the little one has broken through the shell. We have more than once watched the process of hatching, and seen the egg with a small hole chipped in it, through which the tiny bill, with a little ivory white nail at the tip, is trying to force its way out. It is possible that at this stage the old bird assists the chick to break the shell and extricate itself, as on one occasion, when we broke the egg very carefully, and deposited the young one in the nest, it died soon after. Should the old mother be sitting on the nest with her young ones, she drops gently off, and all the little ones scramble out helter-skelter, and so carefully do they conceal themselves, that it is almost hopeless to find them. The nest is often situated in more exposed positions than the one above described, and may be found placed on the water-line in the branches of some overhanging shrub or tree whose boughs touch the water, but always at some distance from the bank, so that a boat is generally necessary to procure the eggs. The latter are from seven to ten or eleven in number, two broods being generally reared in a season, and the number of eggs is less in the second than in the first brood. When swimming the Moor-hen jerks its head as if to keep time with the motion of its legs, which are generally somewhat out of the water, so as to show the tarsal joints, which are red and yellow, shading off into green; and these colours, and its red frontal shield, are the only ornaments about the bird, if we except the two white patches on each side of the tail. The latter is usually carried somewhat erect and with a jerking motion, the bird, as it walks or swims, flicking the latter organ in unison with the movements of its head and legs. When frightened, Moor-hens, especially young birds, often take refuge in trees, and run with considerable rapidity along the branches. The bird is, as a rule, tabooed by keepers, who assert that they are not above visiting pheasantries and carrying off young chickens, whom they despatch with a blow of their powerful bill on the head of their victim; nor can they refrain from stealing eggs when these are left unprotected, sharing in this respect the odium which attaches to their relations, the Coots.

The Moor-hens are found nearly all over the world, and our own species is distributed over Europe, Asia, and Africa, another smaller kind taking its place in the Malayan Islands and extending to Australia. In America Moor-hens are found almost everywhere, while in the Samoan Islands a curious species exists, the *Pareudiastes pacificus*, which is said not to be able to fly.



FOOT OF COOT.

THE FOURTH SUB-FAMILY OF THE RALLIDÆ.

THE COOTS (*Fulicina*).

In appearance and habits much resembling Moor-hens, the Coots are nevertheless a distinct sub-family, distinguished by their lobed toes, which are best understood from a glance at the accompanying woodcut. They have also a larger frontal shield, which in certain of the American species may be really called enormous. Coots are found everywhere, but the South American region possesses the larger number of species, no less than seven being met with in the Neotropical area. Like the Moor-hens the Coots affect the water, but seem to prefer more

exclusively large ponds and lakes, and are not to be found by the river side, where the Moor-hen can always be seen. The Coot also assembles in greater numbers than the Moor-hen, large flocks being often seen in the winter on some of the tidal harbours of the south coast of England.

The Coots are all birds of moderate size, some attaining the dimensions of a small Goose, but the English species does not exceed those of a good-sized fowl. The plumage is extremely close, compact, and impervious to wet, and the body appears rather clumsy to the observer, but in the water the bird's movements are by no means ungraceful, as it swims with the same ducking motion as the Moor-hen already described. The nest is built of dead rushes, often ornamented with the stalks and



THE COOT.

flowers of the marsh-marigold intertwined with the reeds. It is rather a large structure, and somewhat flat, but, though floating on the water, it is always perfectly dry inside. It is built in rather more exposed situations than the Moor-hen's among the branches of a dead bough jutting out of the water, or even among the reeds on the shallow side of a lake. The eggs are about eight in number, as a rule, and are of a light brown colour or yellowish-grey, covered with small dots of brownish-black. The young, when first they emerge from the egg, are prettier than at any other time of their life, being covered with black fluffy down, but having the head red, with a shade of bluish-purple.

THE FIFTH SUB-FAMILY OF THE RALLIDÆ.—THE FINFOOTS (*Heliornithinae*).

These curious birds have the feet lobed as in the Coots, but differ in having a long bill and compressed head, not unlike that of a Heron, and also at the same time somewhat resembling that of a Grebe. Two genera are contained in this sub-family, the first (*Heliornis*), having but a single species, generally known as the American Finfoot (*Heliornis fulica*), from the tropical portions of Central and South America. Prince Maximilian, of Neuwied, states that it is by no means rare on the rivers of Eastern Brazil, but from its habit of concealing itself in the herbage it is not often observed. It may frequently be noticed sitting on a thin branch, partially immersed in the water, and occupied in bowing its head in a most peculiar manner. The plumage is peculiarly soft, and it is said to possess the powers of diving in an inferior degree to most of the Rails. In Africa the *Heliornis* is replaced by the genus *Podica*, of which there are three species, two peculiar to the Ethiopian region, while the third, the Masked Finfoot (*Podica personata*), is a native of the Burmese countries and Malacca.

THE SECOND FAMILY OF THE GRALLÆ, OR WADING BIRDS.—THE SNIPES (*Scolopacidae*).

No portion of the globe seems to be without some representative of this family, some of the members of which are migratory and extend over a wide range, whilst others are comparatively local, the Auckland Islands, for instance, possessing a species of Snipe peculiar to themselves. In the Scolopacidae the bill is long and very slender, as well as weak, so that instead of being firm and horny, as in most Wading-birds, it is flexible and bends under pressure. The wings are long and pointed, and the secondaries are extremely long, nearly equaling the primaries in length. They frequent bogs and marshes or the banks of rivers and ditches, where they are enabled to get their food, which



WING OF SNIPES. (A, Secondaries; B, Primaries.)

consists of worms, insects, and testaceous mollusca, these being obtained by probing the soft ground. They are, as regards the English species at least, almost without exception migrants, visiting the shores of this country in April or May, and departing in August and September, when they assemble in flocks on the sea-coasts, sometimes in considerable numbers. A few species, however, such as the Woodcock and the Snipe, are more generally distributed in England in the winter.

THE FIRST SUB-FAMILY OF THE SNIPES.—THE CURLEWS (*Numeninae*).

These are the largest birds of the family, the Common Curlew, a well-known English bird, being nearly of the same bulk as a chicken, though appearing much larger, from its long legs and enormous curved bill. The bill is always arched, and the nasal groove in which the nostrils are placed reaches to its tip.

The first genus (*Ibidorhynchus*) contains but one species, the Red-billed Curlew (*Ibidorhynchus struthersi*), which is found only in the Himalaya Mountains and the hills of Central Asia. It is said to inhabit in the former range the large rivers which rise from the snow and have a broad, sandy channel. It is nowhere common, and is generally seen singly, though occasionally met with in small parties of five or six. It has no hind toe, and the nasal groove is rather shorter than in the Painted Snipes and Curlews. The second genus contains the Painted Snipes, as they are called (*Rhynchaea*), a genus which is somewhat remarkable from the great difference which is observable in the coloration of the sexes. As a rule, the only distinction between the males and females in the Snipes is one of size, but in the Painted Snipes the females are more richly coloured than the males, having the lores, sides of face, and neck chestnut. This genus is quite an anomaly in the class Aves, where the females are almost always duller-coloured than the males, or at least merely resemble them in plumage, though in some of the Hemipodes (*Turnix*) the colours of the hen bird are brighter than in the males, and in the Hawks the female is generally the larger and more powerful bird. The Painted Snipes are found in Africa, India, and Australia, while one species is met with in the southern countries of the South American continent.

The Curlews (*Numenius*) are found in every part of the world, arriving in the northern regions in summer, and passing south in considerable numbers in the autumn. The note of these birds has something plaintive and wild in its composition, whether it be heard on the moorland, where the species nests, or on the dreary mud-flats of a tidal river or harbour. In the autumn the latter places are visited by numbers of Curlew on their way to their winter quarters, and in many parts they are called by the gunners and fishermen tame Curlews, as they are so much more easily obtained at this season, the reason being that the flocks are then principally composed of young birds of the year taking their first migratory journey south. The old Curlew is a much more wary bird, especially on the return journey in April and May, when he travels, either singly or in company with his mate, to



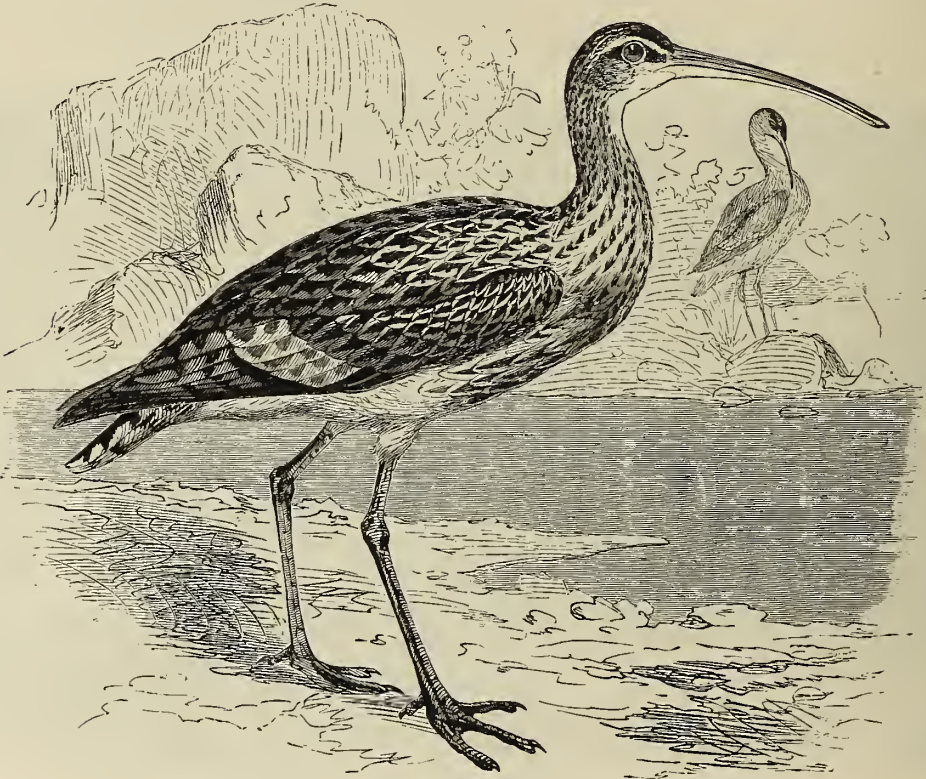
THE COMMON SNIFE.

the upland moors in Scotland and the northern counties of England, where he is to rear his young. In size the Curlew is about two feet and a quarter in length, and has a curved bill of from six to eight inches, and even these latter dimensions are sometimes exceeded.

THE SECOND SUB-FAMILY OF THE SNIPES.—THE SANDPIPERS (*Totaniinae*).

In these birds the bill is straight or slightly curved up, the toes at the base joined by a fold of skin. All the Godwits and Sandpipers make up this sub-family, many representatives of them being met with at the autumn migration on our English coasts. Leaving the little inn, where the collector on a shooting excursion has to put up, he will betake himself to his hunting-ground, which is probably some tidal harbour or mouth of a tidal river. A boat with an apt oarsman, a gun with plenty of cartridges, and a certain stock of food to last for himself and the fisherman during the day's outing, constitute all the outfit which a keen collector will require for his expedition after the Sandpipers. The tide will now be coming in, and the channel in the middle of the harbour, no longer sunk between two deep banks of black mud, will be momentarily broadening under the influx of the approaching tide, so that its course can now be distinctly traced to the mouth of the harbour two miles away. As the sportsman seats himself in the narrow little boat or punt, and his bare-legged pilot pushes her off, takes his seat in the stern, and works her head along by means of his single oar or paddle, the continued cries of the shore-birds resounding far away on every side will tell the listener that they, too,

await the advent of the sea, which will gradually spread itself over the waste of black mud which they have been probing for their food during the livelong night, and drive them foot by foot to the shelter under the banks of the harbour or out on the sea-beach. A small bird flies off with a thin piping whistle from the muddy bank of the main channel, and hugs the margin of the latter till it disappears round the nearest bend. This is the Common Sandpiper, or Summer Snipe (*Tringoides hypoleucus*), returning from his breeding quarters farther north, and now on his way to his winter home in far

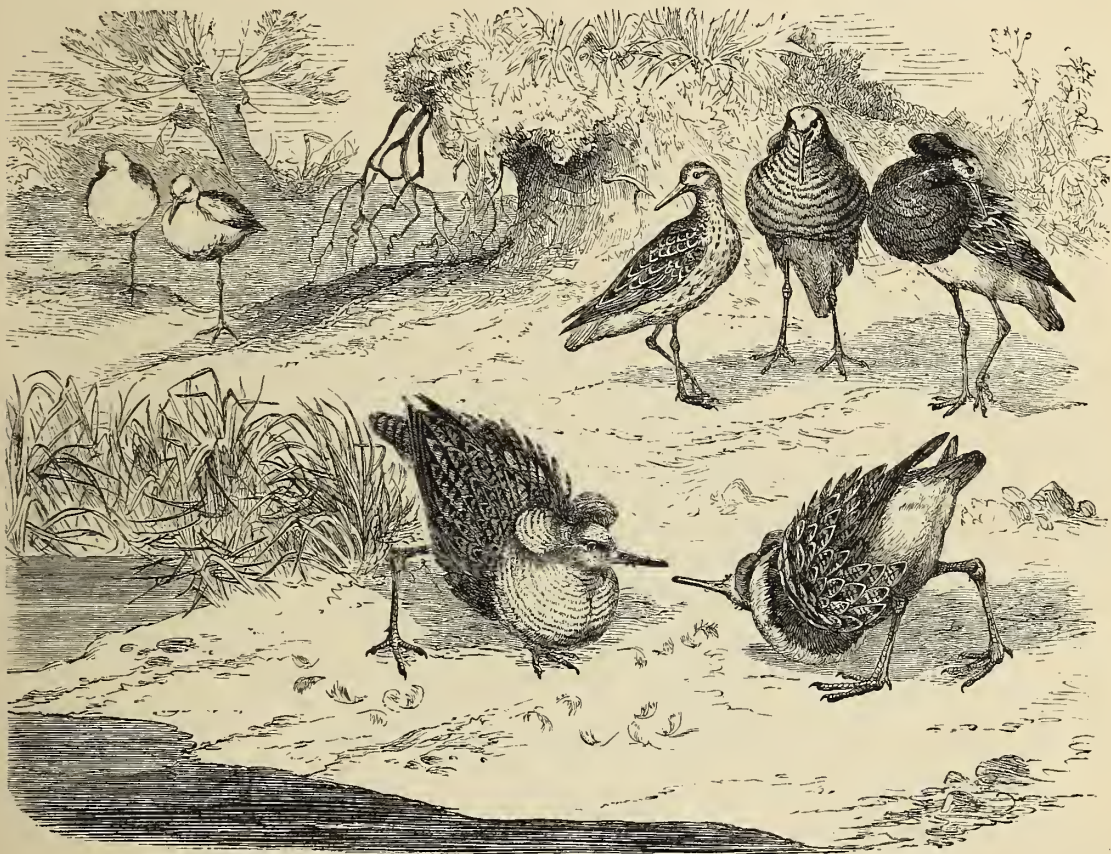


THE CURLEW.

South Africa. It is not only on the sea-shore that we may meet with this elegant little species, for in the spring it may be seen along the banks of our rivers and lakes in company with its mate; while in the autumn the old birds with their family are again observed on the river banks or on its sandy sides, now returning to the sea-coast, where they no longer keep so well together, but are found in scattered parties of two or three, generally very shy and wary.

Those fairy-like birds on ahead, flitting at a little distance above the waves, and every now and then dipping into the water with a splash, are little Terns (*Sternula minuta*), but the eye of the ornithologist is more forcibly attracted by three or four dark objects which stand out against the margin of the sand-bank some three hundred yards ahead. Godwits they are; and already the long, straight beak can be distinguished as the birds sit with their head resting on their buff-coloured breasts. They are evidently uneasy at the approach of the skiff, and evince their fear by taking short runs a little in advance. At length they stop, glance for a moment, and take flight for the shingly beach in the distance, but too late to escape a well-directed double-barrel, which brings down three of their number. Placing them under the side of the boat, the sportsman satisfies himself, by a glance at the banded tail, that they are the Bar-tailed Godwit (*Limosa lapponica*), and not the rarer Black-tailed Godwit (*L. egocephalus*), which also comes to England. The boat is now steered for a shingly island which is evidently not about to be covered by high water, and here, ensconced behind a large heap of seaweed which commands a spit of sand and shingle jutting out into the harbour, the two gunners

await the arrival of the high tide which will soon bring the last vestige of mud-flat under water. They have arrived in the nick of time, for at first singly, and then in small flocks, the Waders make for the sea-shore, in nearly every case crossing the sandy spit on their way, allured in many instances by the subtle imitation of their cries which the fisherman knows how to emit, and thus they leave a considerable number of their comrades in the hands of the gunners. With a musical modulated note of three syllables a little bird comes skimming along far out over the water, and appearing all white as he approaches. He scents danger, however, before he comes too close, and flies away without receiving a shot. This is the Ringed Plover (*Egialitis hiaticula*), and so wideawake a bird that there is small



RUFFS FIGHTING.

chance of getting near a flock of Sandpipers if one of these little Plovers is acting sentinel. Perched on the highest ridge of the shore, he runs provokingly along, keeping a safe distance ahead, and whistling continually, till at last he takes wing, and the sportsman is just in time to see the hurried flight of the flock of Dunlins and Sandpipers, over whom the bird has been keeping guard, far out at sea, with the sentinel Plover in advance guiding them to a safer spot farther down the beach. The Dunlin (*Tringa alpina*) is not often found on the rivers inland, but is an extremely common shore-bird, being generally met with in large flocks, sometimes as many as two or three hundred in number. They are usually very tame, and are easily attracted by whistling, so that a flock, though fired into two or three times, will yet wheel round again and again on hearing the deceptive whistling of the gunner. They go to the north, as a rule, to breed, but during the nesting season flocks may be found on the southern shore of England, which, although in full summer plumage, evidently do not breed, but remain in flocks throughout the whole season. The summer dress of the Dunlin is easily recognisable by the large black horseshoe mark on the

breast. This is lost in winter, when the plumage is ashy above and white below. At the time of the migration of the other Waders the Dunlins are generally putting on their winter plumage, and are met with in all stages of transition.

The Dunlins are not the only visitors to the sandy island where our two sportsmen are waiting for the fall of the tide. A single bird settles and is secured, and proves to be a Curlew Sandpiper (*Tringa subarquata*), a species not unlike a Dunlin in winter dress, but always to be distinguished by its longer and more curved bill, which, from its supposed resemblance to that of the Curlew, has gained for the bird its trivial name. In summer, however, it is very easily told by its deep red breast, for, like the Knot or the Godwits, the whole under surface becomes deep chestnut during the breeding season. Conjectures as to the breeding-home of this species, so widely spread and not uncommon during its two migrations, cross the mind of the shooter who has procured a specimen, for as yet we are ignorant of the place where the Curlew Sandpiper breeds. No longer can this be said of the Knot (*Tringa canutus*), whose nesting-place was unearthed by the last English expedition to the North Pole; and in the British Museum may be seen a pair with their nestlings, procured by Captain Feilden, of the *Alert*; no authentic eggs, however, as yet exist in any collection. The Knot visits our shores in large numbers in autumn, and wanders on its winter migration as far as the Cape, and even to Australia, returning to breed far within the Arctic Circle. In summer the plumage is very rich, the breast being deep chestnut; whereas in winter, like so many other Waders, the back becomes ashy-grey, and the breast white.

One of the most remarkable of all the Sandpipers is the Ruff (*Machetes pugnax*). The males, in the breeding-season, have a conspicuous tuft of feathers on each side of the head, and a large breast-shield of plumes; and the curious part of the bird's economy is that in no two specimens are these absolutely alike. Sometimes the frill and breast-plumes are black, sometimes pure white; occasionally they are rufous barred with black, or grey with white bands; in fact, the combinations of colours are too numerous to be detailed. In winter the Ruff loses this frill and becomes much plainer in colour, resembling the female in plumage, but always maintaining a larger size, so that even in winter dress the sexes can be distinguished. The specific name of *pugnax* is bestowed upon this bird on account of its fighting propensities, the most furious battles taking place between the males for the possession of the females, and in these combats the feathered frills act as a shield for the protection of the combatants. Large numbers of Ruffs are sent annually to the markets of this country, principally from Holland, where the species still breeds, as it does also over the greater part of Northern Europe. The drainage of the English fens, however, has driven it from our own land, where it now only occurs in migration. Its winter home is Africa. The habits of a few of the commoner English Wading-birds which have been treated of above may be taken as examples of the group at the season of the year when they are most generally observed.

THE THIRD SUB-FAMILY OF THE SNIPES.—THE PHALAROPES (*Phalaropinae*).

The Phalaropes are distinguished by their lobed toes, which look like those of a miniature Coot. They combine the characters of several of the Wading-birds, as they swim well by means of their lobes on the toes, which are also united by a web at the base, while they can run on the shores like a Sandpiper. The species are only three in number, and all are inhabitants of northern climates. Two are found in Great Britain, and extend throughout Northern Europe and Northern Asia, while one species, Wilson's Phalarope, inhabits North America.

The Red-necked Phalarope (*Phalaropus hyperboreus*) is a handsome little bird, having the upper parts blackish-grey, varied with reddish edgings to the feathers, the sides of the neck and fore-neck being chestnut, the throat, breast, and abdomen white. Like the Sandpipers, which it much resembles in its appearance, it has a winter plumage, which may be described as blackish-grey, with the forehead, cheeks, and under parts white. The wings have a white band. The Red-necked Phalarope breeds in the Orkney and Shetland Isles, where it constructs its nest in the grass near the edges of lakes, and lays four eggs. Its food consists of insects, worms, and mollusca. It swims with ease, and is often seen far out at sea, migrating southward in winter, when both it and the Grey Phalarope (*Phalaropus fulicarius*), which is the other English species, wander as far as the Indian Ocean, and even to the Moluccas. Dr. Jerdon calls these birds "Coot-footed Stints," which gives a very good idea of the nature of a Phalarope.

THE FOURTH SUB-FAMILY OF THE SNIPES.—THE STILTS, OR
STILT PLOVERS (*Himantopinae*).

These birds are remarkable for their extreme length of leg, which exceeds the whole extent of the body, and for their long slender bill. The Stilts and the Avocets (*Recurvirostra*) comprise the two genera which constitute the sub-family. In the last-named birds the bill is slender and up-turned. Both genera are world-wide in their distribution, occurring in all six regions of the

globe, though they do not wander very far north. In England the Avocet is a very rare bird, though it is still plentiful in some parts of Holland, where it can find suitable breeding-places. As a rule, Avocets frequent the pools in marshes or by the margins of rivers, but some species occur high up in the mountains, as in the case of the Avocet of the Andes. The feet are webbed to such an extent that early writers placed them among the swimming birds, but as a matter of fact they never swim, unless forced to do so, though the webbed feet are admirably adapted for the progression of the bird over the slimy ooze and mud where it seeks its food.

The Stilts have a straight bill, but in other respects they are not unlike the Avocets, and, like the latter, most of the species have a black and white plumage, though in New Zealand a jet-black Stilt occurs. They are more sociable in their ways than the Avocets, being sometimes



THE AVOCET.

found in large flocks, which separate into pairs at the time of the breeding season. At the latter season they frequent fresh or brackish water, but in the winter they are found in the vicinity of salt lakes. The Black-winged Stilt (*Himantopus himantopus*) has more than once occurred in this country. It is a very slender bird, measuring about fourteen inches in length, and the plumage is black and white, the former changing in winter to an ashy blackish shade. The bill is black, the legs pink or carmine-red, and the eye is beautiful carmine.

THE THIRD FAMILY OF THE WADING BIRDS, OR GRALLÆ.
THE PLOVERS (*Charadriide*).

These Wading-birds are similar in habits and ways to many of the Sandpipers, but are much more stoutly built, and have, as a rule, not nearly such long bills. The latter rarely exceeds

the length of the head, and is stout as well as hard in character, with a broad nasal groove. The base of the bill is in many species soft, and forms a kind of cere, while the end of the bill is hard and swollen. The wings are pointed and the secondaries are long. The Plovers may be subdivided into three sub-families, the Turnstones, the Plovers, and the Oyster-catchers.

THE FIRST SUB-FAMILY OF THE PLOVERS.—THE TURNSTONES (*Strepsilatinæ*).

The Turnstones are found everywhere, the common species (*Strepsilas interpres*) being met with all over Europe, and visiting in winter Africa, and even Australia. In South America the Black-headed Turnstone (*S. melanocephala*) occurs, and the New World contains also two very curious birds belonging to this sub-family, each the sole representative of its genus *Aphirza virgata* and *Pluvianellus sociabilis*. The former of these extends along the Pacific coast of South America, down the continent of South America as far as the Strait of Magellan, while the *Pluvianellus* is only known to inhabit the latter locality.

The Turnstone passes by Great Britain on its way to the north in the spring, but does not breed with us. In Norway it nests, however, as well as in high northern latitudes, and the eggs were found near Discovery Bay, the winter quarters of H.M.S. *Discovery* during the recent Arctic Expedition. In the autumn, on the return journey, they are much more plentiful, and may be often seen in small bunches of four or five, sitting quietly on the muddy shore of a tidal river or inland harbour. These companies are for the most part composed of young birds, and are not very shy; occasionally single specimens may be met with on some shingly shore, where their colour serves to conceal them entirely, nor is it till the bird suddenly flies up that its presence is detected.

THE SECOND SUB-FAMILY OF THE PLOVERS.—THE TRUE PLOVERS (*Charadriina*).

The Lapwings (*Vanellus*), the Sand Plovers (*Ægialitis*), the Grey Plover (*Squatarola*), and the Golden Plovers (*Charadrius*), are the best known members of the present sub-family, which is distinguished by not having a hind toe, or at most a very small one. The Lapwings have long crests, which they elevate or depress at pleasure, and they are also remarkable for their enormous rounded wings. These are the birds which lay the "Plovers' eggs," so often seen on our tables during the spring, and large numbers are still sent up to London, notwithstanding the prohibition set upon this practice by Act of Parliament. The Lapwing, or "Pee-wit," as it is generally called, is a familiar object in the early days of spring, when it may be seen flying round and round over the fields or downs, uttering the musical cry so peculiar to the species, and tumbling over and over in the air in the most curious fashion. The male bird is the most demonstrative, and while the hen walks or stands upon the ground, the cock bird circles overhead, flapping his broad wings, and suddenly dipping down in a headlong direction to where his mate is standing. The pair will then take wing together, and perform extraordinary evolutions in the air, very often feigning lameness, in order to draw away an intruder from the eggs. There is generally no nest, and the eggs are not easily found, being laid upon the bare ground in the hollow of a cut or furrow. If approached, the female will, on quitting the eggs, run along a furrow with her body close to the ground for some distance before taking flight, so as to deceive the observer as to the real position of the eggs. When the female is sitting, or the complement of the eggs is laid, she evinces great affection for them, and both parents wheel round and round uttering cries of distress. They are also crepuscular in their habits, and may be seen still on the wing in the gloaming, while their cry is often heard in the stillness of the summer night. In the autumn they frequent the vicinity of the shore in large flocks, the majority of which are composed of young birds, and they are also gregarious in the winter.

Perhaps one of the best accounts of a Plover's habits which can be found anywhere is that published by Mr. Henry Seebohm, in Dr. Dresser's "Birds of Europe," after his return from the expedition undertaken by himself and Mr. Harvie Brown, to the Great Petchora River in Northern Russia. During this celebrated excursion the travellers discovered a number of eggs of the Grey Plover (*Squatarola helvetica*), a species by no means uncommon in England during the spring and autumn migrations, but whose eggs were all but unknown. Altogether, the English travellers found

eleven nests with eggs, and also discovered the young in down. The accompanying extracts from Mr. Seeböhm's account will give a good notion of the breeding habits of the Grey Plover:—"We arrived at Alexievka," he writes, "on the evening of the 19th of June, and on the 22nd crossed the river to the land of promise, the Aarka Ya of the Samoyedes, the Bolshia Semlia of the Russians, the mysterious tundra (a sort of ornithological Cathay) of our little party. We mustered seven altogether, our two selves, our interpreter, Piottuch, and our crew of four, two Russians, a Samoyede, and a half-breed. It was a bright warm day; the wind had dropped, and it was too early in the season for musquitoes to be troublesome. The tundra forms the east bank



THE LAPWING.

of the Petchora; and we had to climb up a steep cliff (perhaps sixty feet high), a crumbling slope of clay-earth, sand, gravel, turf, but no rock. We then looked over a gently-rolling prairie country, stretching away to a flat plain, beyond which was a range of low, rounded hills, some eight or ten miles off. It was, in fact, a moor, with here and there a large flat bog, and everywhere abundance of lakes. . . . We had not walked more than a couple of miles inland before we came upon a small party of Plovers. They were very wild, and we found it impossible to get within shot; but a distant view through our binocular almost convinced us that we had met with the Grey Plover at last. We had not walked very far before other Plovers rose; and we determined to commence a diligent search for the nest, and offered half a rouble to any of our men who should find one. Our interpreter laughed at us, and marched away into the tundra with a 'C'est impossible, monsieur!' We appealed to our Samoyede, who stroked his beardless chin, and cautiously replied 'Mozhna.' The other men wandered aimlessly up and down, but the Samoyede tramped the ground systematically, and after more than an hour's search found a nest on one of the

dry tussocky ridges intersecting the bog, containing four eggs about the size and shape of the Golden Plover's, but more like those of the Lapwing in colour. The nest was a hollow, evidently scratched, perfectly round, somewhat deep, and containing a handful of broken, slender twigs and reindeer-moss. . . . Our seventh and eighth nests of the Grey Plover we took on the 9th of July. We set sail at noon, with a north-east wind, to visit the tundra eight or ten versts higher up the great river. For some distance before we landed the coast was very flat, with willows down to the water's edge. Among these dwarf trees we repeatedly heard the Petchora Pipit (*Anthus seebohmi*), and the Siberian Chiffchaff (*Phylloscopus tristis*). As soon as we got beyond the willows we landed on the tundra, and started in pursuit of a large flock of Buffon's Skuas, but were soon stopped by a pair of Grey Plovers, which showed by their actions that we were near the nest. We lay down as before, about forty or fifty yards apart, and watched the birds. They ran about, up and down, and all round us; and at the end of half an hour we were no wiser than at first. There was evidently something wrong. Harvie Brown then shouted to me, 'Have you marked the nest?' I replied by walking up to him and comparing notes. We then watched for another half hour with exactly the same result. I suggested that we must be so near the nest that the bird dare not come on, and advised that we should retreat to the next ridge, which we accordingly did. We had not done so many minutes before the female made her way on to the ridge where we had been lying. She then ran along the top of the ridge, passed the place where we had been stationed, and came down the ridge on to the flat bog towards where we then were. I whispered—'She is actually crossing over to us!' Suddenly she stopped, lifted her wings, and settled down on the ground. . . . Harvie Brown lifted his gun to his shoulder. She ran off the nest to the top of the ridge till he tumbled her over. We then walked up to the nest, the first we had seen on the flat. The eggs were quite fresh, or nearly so; and the nest must have been made nearly a fortnight later than those we had previously taken. During that time the bogs had become much dryer, so that we could cross them without much difficulty; and this would probably be the reason why this nest was placed lower down. The eggs had all the appearance of a second laying, being less blotched than usual, one of them remarkably so. It is worth noticing that whilst we were watching in our first position, very near the nest, the birds were nearly quite silent, and did not call to each other as they usually do.

"Our ninth nest of the Grey Plover we took on the 12th of July. A stiff warm gale from the east, with occasional smart showers of rain, kept the air clear of mosquitoes in the morning. In the afternoon the wind fell, and the mosquitoes were as bad as ever, but we were too busy to heed them much. At eleven we crossed to the tundra. We soon came upon a pair of Grey Plovers, which rose a couple of hundred yards ahead of us, their wings glittering in a gleam of sunshine after a smart shower. These birds have frequently a very curious flight as they rise from the nest, tossing their wings up in the air, reminding one somewhat of the actions of a Tumbler Pigeon. We lay down, as near the nest as we could tell, near the spot from which they rose, and were somewhat puzzled at their behaviour. The male seemed as anxious as the female, if not more so, running about as much as she did, continually crying, and often coming very near us, and trying to attract our attention by pretending to be lame. The female rarely uttered a note. We suppose this must have been because one of us was too near the nest. Harvie Brown moved his post of observation, after we had spent some time without being able to discover anything; and then the female behaved as usual, and I soon marked the position of the nest. We walked straight up to it, and found the four eggs chipped for hatching. We had no difficulty in shooting both birds, and afterwards hatched out two of the eggs, obtaining a couple of good specimens of young in down. With a little practice this mode of finding birds' nests becomes almost a certainty. One has first to be quite sure which is the male and which the female. When the birds are near enough, and one can compare them together, the greater blackness of the breast of the male is sufficient to distinguish him; but we found that the females varied considerably in this respect, and that it was better to notice the habits of the birds. The female usually comes first to the nest, but she comes less conspicuously. She generally makes her appearance at a considerable distance, on some ridge of mossy land. When she has looked round she runs quickly to the next ridge, and looks round again, generally calling to the male with a single note. The male seldom replies, but when he does so it is generally with a double note. When the female has stopped and looked round many times, then the male thinks it worth while to move; but more

often than not he joins the female by flying up to her. The female very seldom takes wing. She is very cautious, and, if she is not satisfied that all is right, will pass and repass the nest several times before she finally settles upon it. She rarely remains upon the post of observation long, but the male often remains for ten minutes or more upon one tussock of a ridge, watching the movements of the female.

"We walked some distance before we came upon a second pair; but at length we heard the well-known cry, and got into position. We spent nearly two hours over this nest, and were quite at sea by the end of the time. We changed our position several times, but to no purpose. The female went here, and there, and everywhere, as much as to say, 'I'm not going on to the nest as long as you are near.' At last the mosquitoes fairly tired us out, and we gave up the watching game, and commenced a search. We soon found out the secret of the bird's behaviour, when we picked up some broken eggshells, and concluded at once that the bird had young. We tried to find them, but in vain. These two hours, however, were not wasted. The birds came nearer to me than they had ever done before. I often watched them at a distance of not more than ten yards, and was able to hear their notes more distinctly. The note most frequently used is a single plaintive whistle, *köp*, long drawn out, the *ö* pronounced as in German, and the consonants scarcely sounded. This, I am almost sure, is the alarm-note. It is principally uttered by the female when she looks round and sees something that she disapproves of. If the male shows any anxiety about the nest, which he seems to do more and more as incubation progresses, he also utters the same note. The double note, *kl-ee* or *kleep*, the *kl* dwelt upon, so as to give it the value of a separate syllable, is also uttered by both birds. It is evidently their call-note. I have seen the female, when she has been running away from the male, turn sharp round and look towards him when he has uttered this note, exactly as one might do who heard his name called. Whilst we were watching this pair of birds a couple of other Grey Plovers came up, and called as they flew past. The male answered the call and flew towards them. On the wing this whistle is lengthened out to three notes. I had some difficulty in catching this note exactly. It is not so often uttered as the two others I have mentioned, and is generally heard when you least expect it; but I am almost sure it is a combination of the alarm-note with the call-note *kl-ee-köp*. If I wanted to make a free translation from Ploverski into English, I should say that *kl-ee* means 'Hallo! old fellow!', and *köp* means, 'Mind what you are about!'"

Mr. Seebohm's notes, of which the above are only a fraction, also give accounts of other Wading-birds and Plovers which he met with during his adventurous journey, but they are too long to be quoted here. The Asiatic Golden Plover (*Charadrius fulvus*) is a bird which in appearance is a slender long-legged form of our common Golden Plover (*Charadrius pluvialis*). To the naturalist the Grey and Golden Plovers are easily distinguishable, for on lifting the wing the black axillary feathers of the Grey Plover are very striking, these being white in the Golden Plover, and smoke-grey in the Asiatic Golden Plover. The colour of the axillary feathers is a useful character in distinguishing the young birds, as the Grey Plover in its first autumn plumage is spotted with golden, and might easily be mistaken for a Golden Plover. The Sand Plovers (*Ægialitis*), of which the common Ring Plover (*Æ. hiaticula*) of England is a type, have similar habits and food to the larger species spoken of above, but they frequent more the beach and sandy shores of the sea, lakes, and rivers, laying four eggs in a slight depression in the sand, and the young, when first hatched, run about, and on the approach of danger squat down, when the assimilation of their colour to the surrounding shingle or sand serves to conceal them admirably.

THE THIRD SUB-FAMILY OF THE PLOVERS.—THE OYSTER-CATCHERS (*Haematopodinae*).

The Oyster-catcher, or Sea Pie, as it is often called, from its black and white coloration, is often seen in England in considerable numbers on the shore, or in small parties of five or six together, in the autumn. These latter generally consist of a family of birds, which have been hatched in the more northern parts of England, and are now on their way southward. Single birds are by no means difficult to obtain at that season of the year, as their whistle can be easily imitated, and thus the bird can be attracted within range. In April the flocks disperse for the breeding-season, the Oyster-catcher nesting on the rocky shores near the sea, generally in unfrequented places. It is one of the handsomest of the Waders, being of a black and white colour, with a red bill and purplish-red legs.

Oyster-catchers are found in nearly every part of the world, and in the southern parts, that is, in South America, South Africa, and Australia, there are three species, which are totally black in colour.

THE FOURTH FAMILY OF THE WADING BIRDS, OR GRALLÆ.

THE BUSTARDS (*Otididæ*).

There is so much that is like a Game-bird in the Bustard, that it may well be considered to form a link between the *Gallinæ* and the Plovers. In the present family the general tone of the plumage is sandy-coloured, vermiculated with blackish lines and cross-markings. The gape is very wide, the mouth being cleft to beyond the region of the eye; the toes short and thick. The bill is in every instance



THE THICK-KNEE, OR STONE CURLEW.

short, and the wing is short and convex, the central quills being shorter, and the secondaries nearly equal in length to the primaries. The tail is always large, and there is no hind toe. The most Plover-like of the family of Bustards are the Thick-knees, or Stone Curlews (*Ædicnemus*), and the Coursers (*Cursorius*). The first of these genera occurs in nearly every part of the globe, and the members of it are remarkable for their more pointed and Plover-like wing, while they have the toes united at the base with a web. The eye is also very large, and the tarsi are reticulated. They frequent downs and large waste lands in this country, and the English species (*Ædicnemus crepitans*) is often called the Norfolk Plover, as it is in that county that it is still principally found. We have, however, noticed a pair for several successive years on the Hampshire Downs. They inhabit desert places generally, and are very shy, being strong of flight, whilst they also run with great speed. The Coursers (*Cursorius*) differ from the Thick-knees in having the tarsi covered with transverse scales in front, while they are altogether smaller birds. They frequent the deserts, and are not found in northern parts of the globe, nor do they occur in the New World. From the similarity of colouring which these birds exhibit to the sandy wastes they inhabit, they are with difficulty observed, and their shy disposition makes them hard to obtain. This is more especially the case with the Cream-coloured



THE GREAT BUSTARD.

Courser (*Cursorius isabellinus*), a species which has occasionally wandered to our shores. Jerdon says that the Indian species (*C. coromandelicus*) is very abundant in the Deccan and Western India. It associates in small flocks, frequenting the barest plains and ploughed lands, and is very abundant on the parade ground at Jalna. It runs about rapidly, nodding its head occasionally when it stops, and picks up various insects, chiefly Coleoptera and the larvæ of certain grasshoppers. Burgess states correctly that it has the peculiar habit of running for a distance at speed, suddenly stopping, erecting the body, and then starting up again. It breeds on a hollow in the ground, from March to May, laying generally three eggs of a pale greenish-yellow colour, much blotched and spotted with black, and with a few dusky olive spots. It is rather a silent bird.*

The True Bustards are much larger birds than the Thick-knees, or Coursers, and have no basal web to the toes, the claws being stout, obtuse, and very short. The males are larger than the females. The Great Bustard (*Otis tarda*) used to be found on the fen lands and plains in this country, but has been banished by the increase of drainage and the extension of civilisation. In many parts of Europe, however, it is still plentiful. The following short sketch of this bird has been condensed from Dr. Brehm's account of the species:—

It is found in Germany, and also frequents the south and east of Europe. Africa, with its flat deserts, gives it shelter, as well as Central Asia. The handsome, muscular form, and its many characteristics, combine to make it a most interesting bird, and, perhaps, also the difficulties experienced in its capture make a knowledge of its economy still more desirable. On occasions when it extends its finely-developed tail, and distends its neck, with its prominent moustache, it has a most dignified appearance. The female is much smaller than the male, though specimens vary according to age; a full-grown male will measure 3ft. 6in. from the tip of the beak to the end of the tail, and 8ft. from wing to wing. The pouch attached to the throat of the male is filled with air, allows the neck to be distended, and is also asserted to be a medium of strength to his voice, when he puts special pleading in his wooing. The plumage is varied; yellowish on the upper parts, varied with wavy lines of black, the under parts pale clay colour, the head and part of the breast ash-grey, the tips of the tail-feathers and some of the wings white, and the pinion feathers black. The Bustard, to secure a resting-place far from the haunts and attacks of men, displays immense intelligence; its caution and sagacity are most extraordinary, and it is amusing to notice how it will take advantage, for future benefit, of past experiences and escapes, and a lesson is never allowed to pass unheeded. Large, flat, open plains are its favourite haunts, and in selecting such spots it shows its wisdom, as there the approach of the hunter is easily detected, and even in Africa, where they sometimes live among high grass, they contrive to elude the enemy. One would suppose that when the bird is asleep it might be surprised; not so, however, for two old wary sentinels keep guard, and are always on the alert. The nesting-places are also fixed in very remote spots. They have a powerful agent in their splendid sight, and they are so clever that if they see anybody approach, who does not seem to have any particular business, no matter how much disguised, they take fright, and off they go. They may even have inhabited a chosen spot for some time, and yet, if they fancy that there is a little change in the familiar look of the place, they shift their quarters at once. Their sense of smell and hearing is less acute, and thus they may be captured by some skilful tactics, as, for instance, a covered pit, where the hunter is invisible, or a hut constructed during the last seed-time, into which the hunter introduces himself, and bags his prize as the Bustard walks comfortably past. The movements of this species are very quick, and it walks immense distances. Some assert that it experiences difficulty in preparing for flight, but this is not the case, for it flies very rapidly in the air, and gets its impetus by a short run. One can easily imagine that great *finesse* is required in their capture, firearms alone being of any use. We must now notice the food, habits, and maternal instincts of this bird. The food consists of various insects, all kinds of plants, seeds, fruits, &c. Green food is a favourite diet in summer, and to some extent in winter; but at this season it makes the rape-fields the scene of its operations, grazing in them at intervals during the day, and flying off at evening time to roost quite two miles away. It resembles the Goose in the manner of its grazing, and also in the way it cleans its feathers with dust. It also improves digestion by means of small stones, &c., which it swallows in great

* "Birds of India," Vol. II., p. 627.

numbers. Its wooing gives it an opportunity to show fresh qualities. This important affair comes off in the month of February, and at this time of year the Bustard feels very unsettled and unsociable; he quits his companions, and puts on his best appearance for conquest. Not the least part of the wooing is the combat that he often has with rivals on the way, and the struggle between these competitors for the fair one's regard is fierce and bitter. As they go struggling in the air they look like some birds of prey. The victor, of course, is rewarded with his spouse, and off they go together, to establish a home and found a family. The hen bird alone sees after all the business of incubation, the male meanwhile guarding her, and remaining true to his love. In a small hollow scraped in the ground two rather large eggs are deposited about the beginning of May; they are of a pale greenish tint. If these eggs are touched by man they are quite forsaken, unless so nearly hatched that the maternal instinct is aroused, and she completes the process. The chicks gather strength after a few days, and at the third week change their down for feathers, and at the fourth are ready to fly. Their food, supplied by the loving mother, consists of little insects, grasshoppers, &c. Ants' eggs are esteemed a great delicacy. It is a pity that these little things are liable to the attacks of Kites and Goshawks. The mother does her best to shield her precious ones, and often successfully, but, alas! when Eagles and Foxes catch sight of this tempting food, the mother's efforts are too weak, and many fall victims. We have heard of a Bustard attaining the age of fifty years, and even more; so they seem to know how to take care of themselves. As to Bustards being tamed, it is possible. We read of one being kept in a house at Khartoom, and enjoying the society of its owner. The adult Bustard, when imprisoned, requires plenty of space to take his pleasure, and show himself off, but in the Zoological Gardens the male may occasionally be seen in the spring time going through the most extraordinary positions, unexcelled for a love-display by any of the game-birds. The pouch under the tongue, which is supposed to add to the appearance of the bird by being inflated at will, is by no means present in every specimen dissected, and its exact use and object do not yet seem to be clearly defined.

THE FIFTH FAMILY OF THE GRALLÆ, OR WADING BIRDS.

THE CRANES (*Gruinæ*).

The Cranes may be subdivided into three sub-families, the Kagus (*Rhinocetinae*), the Sun Bitterns (*Eurypyginae*), and the true Cranes (*Gruinæ*). The Kagus are represented by the single species *Rhinocetus jubatus*, of New Caledonia, the *Eurypyginae* also by a single species (*Eurypyga helias*) from South America. Professor Sundevall places the singular Australian bird, *Pedionomus torquatus*, of Gould, along with the Kagu in the first-named sub-family. Both the Kagu and the Sun Bittern may generally be seen living in the Zoological Gardens, and they go through, even in captivity, the extraordinary antics which seem to be characteristic of the Crane family throughout the globe. The true Cranes (*Gruinæ*) are found in almost every part of the world, with the exception of South America, and are birds of stately form and grand demeanour, though their habits of bowing and dancing, which they indulge in both in a state of nature and in captivity, tend to make them occasionally somewhat ridiculous.

THE COMMON CRANE (*Grus cinerea*).

This is a rare visitor to England, though it has been stated to have bred in the fen-lands in years gone by; at the present day, however, it occurs only accidentally. In the continent of Europe it is a regular summer visitor, breeding in marshy places in the more northern parts, and occurring in the south on migration, when the flocks pass in the form of a triangle, or in a straight line. In captivity the Crane not only becomes very tame, but displays great intelligence, as may be imagined from the celebrated story related by Dr. Brehm in his "Bird Life," of a domesticated Crane belonging to Von Seyffertitz, who gives a most interesting account of some young birds which he had. A few extracts from this story are given to illustrate the sagacity which the Crane displays:—"The extraordinary cleverness and trustful character of my young Cranes," writes Von Seyffertitz, "have reached such a degree of cultivation, that they engage the attention and awake the astonishment of all who see them. In a very short time they not only lost all fear of man and domestic animals, but even sought the companionship of the former. They knew

exactly all the houses in the place where the inhabitants had once given them anything, and never omitted to pay them a daily visit. Without the slightest timidity they entered the lower rooms of our house, often remaining there some time, and feeding out of the same dish with a very large Pointer. I fed them three times a day, and they were thoroughly aware when this took place. They arrived at the proper time, and announced themselves by screaming. If the time seemed too long they marched into the kitchen and waited by the fire until their dinner was ready. They would accompany me and others in our walks, following us like dogs; sometimes taking a flight they gambolled about in the air, alighting occasionally, and then continued to accompany us. It was a pleasure to have these charming creatures about us." One of them having perished by an accident, the survivor consoled himself by a greater activity of life. "As it was out of my power," continues the narrator, "to replace the loss he had sustained by another of his own species, he helped himself. He chose a fresh companion, with whom he contracted a new friendship, which still exists. You will hardly imagine the one he chose from among the many creatures surrounding him. It was none other than a bull on our estate. How, and from what reason, the friendship sprang up, I cannot exactly make out, though it appears to me that the bull's loud bass voice produced some especial effect. To be brief, the two became fast friends ere spring time; the Crane accompanies his horned favourite daily to the pastures, and daily visits him in the stable. He treats him always with the most marked deference, and evidently considers him as his superior. In his stable he stands respectful and erect by his friend, as though obliged to await his orders, keeps the flies off him, answers when he roars, and takes every possible means to pacify his friend when enraged. When the bull is among the cattle in the yard he plays the part of adjutant, generally walking about two paces in his rear, often dancing round him, bowing respectfully, and, in fact, behaving in so droll and comical a manner that no one could look on without laughing. In the afternoon he follows the bull and the whole herd to the meadows, a distance of more than two miles, and returns with them in the evening. The bird generally follows some few paces in the rear of his friend, or else walks alongside of him, or suddenly precedes him and runs on twenty yards or more, and then, turning round, bows down before his august companion until the latter has come up with him. These proceedings are carried on through the whole village, to the intense amusement of the inhabitants, until the farmyard is reached, when, after repeated bows and demonstrations of affection, he takes leave of his respected companion." After relating how the Crane reigned supreme in the poultry-yard, and even took the horses and foals in hand and kept them in trim, the story continues:—"He keeps the cows and oxen in order, both in the yard and in the fields, and assists to drive them backwards and forwards, and always separates them if they take to butting one another. If they refuse to obey, he tries the effect of his loud ringing voice, which generally so alarms them that they speedily take to flight. In the fields he keeps the herd together, and prevents their getting into mischief. One evening he brought home, unaided, a whole herd of heifers, and drove them into the stables. This bird has undertaken so many jobs that he is employed the whole day long. Recently he returned to his other duties, after having assisted in driving the village herd of cattle to the pasture. In passing through the hamlet he found some heifers belonging to the herd which had remained behind, whereupon he instantly set about driving them down to those in the meadows. He drove them safely through the village, but frightened them so with his screams and blows with the beak, that they ran away, and took the contrary direction to where the rest of the herd had gone. He ran quickly after them to try and bring them back, but to no purpose. The chase continued for over two miles, finishing in a field of corn belonging to the neighbouring village, where the cattle and their feathered herdsman were pounded: the latter, however, would not allow himself to be caught, but returned home, disconsolate at his want of success. . . . To us he behaves in a most polite and amiable manner. When hungry, he generally presents himself under my mother's window, as she is exceedingly fond of him, and feeds him several times during the day. Here he calls; if he is not heard he enters the house, calling louder and louder, till at last he takes refuge in the kitchen, where he seeks his friend and caterer, the cook, to whom he details his requirements. He shows his pleasure at her appearance by uttering the familiar cry, *Coor, coor, coor, coor*, and makes her understand, by all manner of antics, how he wishes to be fed. If he wants bits of bread from the hand, which is his principal food, he points to it with his beak; should he, however, wish to be fed on the floor, he lays a piece down there, and then she must throw all the rest there. This bird always shows



DEMOISELLE, CROWNED, AND COMMON CRANES.

most obedience to my mother and her servant, and he misses the latter immediately she is absent, in which case he seeks her with the greatest diligence, stealing into the house and under her window, listening attentively for the sound of her voice or for her footstep, for he recognises the latter from afar. While young, she was always obliged to carry him to his sleeping-place, owing to his great dislike to going there himself. If the weather was bad he liked to be taken to bed early; if, on the contrary, it was fine, he would hide up in the evening at the approach of his keeper. Now he no longer seeks her assistance, but his friendship for her is still the same, and it is only when she allows him to call in vain for his food, when hungry, that he shows his displeasure."

THE SIXTH FAMILY OF THE GRALLÆ, OR WADING BIRDS.—THE TRUMPETERS (*Psophiidæ*).

This family of birds is entirely peculiar to South America; and only six species are at present known. They differ from the Cranes in having the bill much shorter than the head, the culmen being arched, and curving downwards at the tip. The plumage is very thick and close, and the wing is concave, fitting tight to the body; it is at the same time broad, the centre quills being only a little shorter than the primaries and secondaries. The tarsus is scaled both in front and behind. The Trumpeters inhabit the forests, frequenting the ground in search of grain and food. Their presence is often betrayed by their loud call, which has gained them the name of "Trumpeter."

CHAPTER IX.

THE HERONS—THE GEESE AND WILD FOWL—THE PELICANS—THE SEA-BIRDS.

THE HERONS—Characters—THE TRUE HERONS—THE COMMON HERON—Mr. Harting's Account of its Habits—Heronries—Egrets—Hungarian Breeding-places—Feeding the Young—THE STORKS—The Umbre, or Brown Stork—The Shoe-billed Stork—The Characteristic Bird of Central Africa—The White Stork—Protection afforded them in Various Countries—The Adjutant—The Marabout—THE SPOONBILLS AND IBISES—THE SPOONBILLS—Their Peculiar Bill—Habits—THE IBISES—Species—Dr. Brehm's Remarks on the Sacred Ibis—THE FLAMINGOES—THE GEESE AND WILD FOWL—THE SCREAMERS—THE DUCKS—Characters—THE GEESE—Dwarf Geese—Cereopsis Goose—Spur-winged Geese—Grey or Wild Goose—Sea Geese—Brent Goose—THE SWANS—The Wild Swan—The Black Swan—THE DUCKS—The Wild Duck—The Mallard—SCOTERS—EIDERS—MERGANSERS—THE STIFF-TAILED DUCKS—The Diving Ducks—THE PELICANS—THE FRIGATE BIRDS—Habits—Visit to a Breeding place—Domesticated—THE TROPIC BIRDS—THE PELICANS—The Common Gannet—Visit to a Colony of Boobies—The Darter, or Snake-neck—The Cormorants—A Colony of Cormorants—The Pelicans—Characters—Habits—Perching on Trees—Fishing—THE SEA-BIRDS—Characters—THE SCISSOR-BILLS, OR SKIMMERS—THE TERNS or SEA-SWALLOWS—"Wide-awake Fairs"—White Noddies—THE TRUE GULLS—Characters—The Black-backed Gulls—Herring Gulls—Skuas—THE PETRELS—Distribution—The Diving Petrel—The True Petrels—The Albatrosses—Capt. Hutton's Remarks on their Unrivalled Powers of Flight.

THE SEVENTH ORDER OF BIRDS—THE HERONS (*Herodiones*).

In the order of Heron-like birds the nostrils will be found to be small, placed rather high in the mandible, the bill being at the same time very hard and horny. The bill is longer than the head, and is united to the skull by firm, broad bones. The wings are always of large size. As a rule, the Herons are big birds, and make their nests in trees, whither they bring food to their young, who remain for some time in the nests, and are not able, like the majority of Wading-birds, to provide for themselves when they are hatched. They are also covered with down of a long, loose character, and they have large crests of down on the head when in the nest.

THE FIRST FAMILY OF THE HERODIONES.—THE TRUE HERONS (*Ardeidæ*).

The true Herons may be distinguished by their large hind toe, which rests on the ground like the others, and is furnished with a very big claw, or nail, which is equal in size to the claw of the middle toe. The latter has a pectinated or comb-like edge on its inner margin. The wings are very large and the flight is slow. The lores and region of the eye are also bare.

THE COMMON HERON (*Ardea cinerea*).

Much might be written about the habits of this interesting bird, as many excellent accounts of its habits have appeared in ornithological works, but nowhere, perhaps, has a better idea of

the habits of the Heron been given than that by Mr. Harting, in his "Hints on Shore Shooting."

"On most parts of the coast the Heron may be seen at low water, fishing in the little pools which have been left by the receding tide. Here he finds crabs, shrimps, and other delicacies; but instead of being sociable, like the Gulls and Redshanks, and inviting a friend to join him



THE GREAT WHITE HERON.

at dinner, he goes to his own particular pool, like an old gourmand to his club, and keeps the best of everything to himself.

"We have watched him on the rocky weed-covered shore of Northumberland, on the shining sands of Lancashire, and on the dreary mud-flats of the Sussex harbours, and have found him always the same; shy and suspicious, even when seldom disturbed, he seems to have a wonderful eye to danger, and we almost believe can distinguish a gun from a stick or an umbrella.

"Now and then, upon a rocky coast, we have stalked him under cover of a friendly boulder, and while our heart beat loud with rapid exertion and excitement, we have shot him just as he had detected our head above the rock. And what a triumph we have felt in standing over his prostrate form, and smoothing his expansive wings, feeling in that moment a sufficient reward for having

crawled, on hands and knees, perhaps three hundred yards of treacherous ground, slipping over seaweed, and through salt-water pools! But it was never thus on the mud-flats; there no friendly barrier intervened to screen our approach, and we could advance only near enough to be just out of shot, when the large wings were unfolded, and we were left to stand and gaze wistfully after the coveted prize. Now and then, at early dawn, we have come suddenly upon a Heron while busily employed under the steep bank of a brook, and have thus been enabled to knock him down with snipe-shot before he could get out of range. It was ludicrous to observe the surprise of the bird when he first became aware of our presence, and with a hoarse croak clumsily endeavoured to get away. On



THE PURPLE HERON.

one occasion, accompanied by a red Setter, we were stalking a Heron, when the dog, over anxious, ran forward, and attracted the attention of the bird, which immediately took wing. Instead of flying away, however, he hovered over the dog, looking down at him like a Hawk. We crouched down, and gave a low whistle, and the dog, coming back, actually brought up the Heron within shot, when we fired and killed him. The bird seemed to follow every movement of the dog, and was so intently eyeing him, that he never saw us until the gun was raised. He then turned at once to make off, but too late.

"On the coast the Heron feeds at low water during the day, and in unfrequented marshes he may also be caught fishing in broad daylight; but when compelled to get his living at reservoirs, ponds, and rivers, which are oftener visited by his enemy, man, he prefers to come just before daybreak or after dusk. In autumn, when the brooks run dry, we have frequently noticed the impressions of his long toes, visible for miles on the soft mud, showing the great extent of ground traversed in his patient search for food. Fish, frogs, mussels, and even water-rats, are all included in the Heron's bill of fare.

He will take young water-fowl, too, from the nest, and after pinching them all over in his formidable bill, and holding them under water till they have become well saturated, he throws up his head, opens his mandibles, and the 'Poule d'eau souchée' disappears.

"Some years ago we paid a visit, in the month of May, to a certain reservoir in Yorkshire, where the Pochard (*Anas ferina*) was known to have bred, our object being to ascertain whether this duck was then nesting there, and to learn what other fowl were on the water. We might say a good deal of that pleasant excursion, but must confine our attention for the present to the Heron. At one end of the reservoir is, or was, a thick bed of willows, extending out some distance from the shore. The



THE NIGHT HERON.

water at this spot is shallow, with a muddy bottom. Coots and Moor-hens were numerous and noisy, swimming about amongst the willows, and collecting materials for their nests. We lay upon the grass at the edge of the water, peering quietly through the willows, and learnt a great deal of the private life of these water-fowl. While we were gazing, a Heron, which must have flown unnoticed up the water, dropped suddenly in the shallow, within twenty yards of our ambush. Here was an opportunity for observation. Scarcely venturing to breathe, we watched with interest every motion of the great grey bird. His long black crest and pendent breast-feathers showed him to be fully adult, and we thought at the time we had seldom seen a Heron in finer plumage. With head and neck erect, he took a cautious glance all round, as if to satisfy himself that he was unobserved, and apparently assured, he then looked down at the water. For some minutes he never altered his position, till at length, bending slowly and gracefully forward, he suddenly struck the water with his bill, and recovered a small fish. A pinch, a toss of the head, and it had disappeared down his throat. He then drew himself together with apparent satisfaction, wiped his bill upon his long breast-plumes, and slightly altering his position,

prepared, as an angler would say, to make another 'cast.' At this moment we incautiously moved a little to one side to avoid a willow-bough, and obtain a better view, when his quick eye instantly detected the movement, and in another second he was flying down the water in the direction whence he had come. There are few sights more gratifying to a naturalist than a heronry. We have had the privilege of visiting three, one at Walton Hall, Yorkshire, the seat of the late Charles Waterton; one at Milton, near Peterborough, belonging to the Hon. George Fitzwilliam; and one at Wanstead, the property of Lord Cowley. Did space permit, we might give a detailed and interesting account of all we saw on these occasions, but we can do no more than offer a few brief remarks on the general appearance and situation of the heronry last named.

"The date of our visit was the 5th of April, and the birds were then sitting on their eggs. The Heron is one of the few Waders which resort to a tree for the purpose of nidification, and a stranger sight than a number of these great birds can scarcely be imagined. Twenty years ago, the Herons at Wanstead Park tenanted some trees at a different spot to that which they now frequent. At present they occupy some tall elms upon an island in the largest piece of water in the park. The keeper informed us that there were about thirty pairs. We proceeded to the boat-house, and after bailing out the boat, which was nearly full of water, steered for the Heron's island. A good glass enabled us to see the birds very clearly, and most of them were in splendid plumage. The nests were placed at the very top of the trees, and many of them were occupied by a sitting bird.

"Here and there a Heron stood erect upon a bough, with head and neck drawn in, looking for all the world like a cold sentinel, with his bayonet between his teeth, and his hands in his trousers pockets. As we approached the island, several loud croaks were heard, and the sentinels took wing, the sitting birds being the last to leave. Taking it for granted that the bird which sat the longest was the most likely to have eggs, we selected a tree from which a Heron flew as we reached it. It was a wych elm, about forty feet high, and the nest was placed amongst the topmost branches. After a fatiguing climb, owing to the absence of boughs for a considerable distance, we reached the top, and paused to rest before looking into the nest. And now was the anxious moment. Were our exertions in vain? Was the nest empty, or were we to be rewarded with the sight of eggs? The nest was large enough to sit in, composed externally of large twigs, chiefly elm and willow, and lined with smaller twigs, fibre, and dry grass. It overhung our head to some extent, so that we were obliged to pull away a portion of the side before we could see into it, when, to our delight, four beautiful eggs were displayed, their bright bluish-green colour contrasting well with the dark fibre on which they were laid.

"The wind blew in gusts, and it was no easy matter to get them down safely; but at length we succeeded in getting them into our handkerchief, and holding the ends together in our mouth, brought them down without a crack. They were considerably incubated, showing that they had probably been laid about the end of the third week in March. The Heron, indeed, is one of the earliest birds to breed. The young, when first hatched, present a very remarkable appearance, and are fed by their parents for a long time before they can shift for themselves.

"A friend once kept a Heron on his lawn, and a very amusing bird he was. When first captured he was very sulky and refused all food. Fearing he would starve, the owner forced some fish down the bird's throat, but the next moment saw it returned upon the grass. The process was repeated, with the same result, and a third time my friend endeavoured ineffectually to overcome the obstinacy of his captive. At length, reflecting how the Chinese treat their tame Comorants, by fastening a strap round the neck to prevent the fish from going down, he tied a piece of tape round the Heron's throat, to prevent the fish, in this case, from coming up. The experiment was perfectly successful, and the bird, finding it impossible to disgorge, at length abandoned the attempt, and subsequently fed himself. Fish were placed for him in a fountain on the lawn, and he evinced great delight in taking them from the water. One day a rat was observed helping himself to the Heron's food. The rightful owner caught him in the act, and with one blow of his formidable bill felled him to the ground. Seizing him, then, before he could recover, he carried him squeaking to the fountain, and ducked him. After shaking him well under water, he held him up for examination. The rat spluttered and squeaked in abject terror, and again was he submerged. The dose was repeated, until the unfortunate rat at length succumbed, and being by this time nice and tender, the Heron pouched him, and his thin, elongated

form was seen distending the thin skin of the bird's neck in its passage downwards, until it finally disappeared for ever."

The writer remembers, as a boy, paying a visit to Lord Fitzwilliam's heronry, at Milton, near Peterborough, one of the breeding-places mentioned by Mr. Harting in the foregoing account. On many of the nests, which were placed at the top of some high trees, two birds were sitting side by side, silent and unmoved as statues, save for the rocking which the gale of wind gave them. It was blowing hard at the time, and many nearly full-grown young birds were on the ground walking about, whilst



THE LESSER EGRET.

not a few were entangled in their fall among the branches, and were liberated by us youngsters, not without fear of an attack from the old birds, who croaked most ominously above our heads.

The general colour of the Heron is grey above, white underneath, the breast black, with a white patch in front. The throat and fore-neck are white streaked with black. On the head is a beautiful pendent crest of black plumes. The forehead is white.

Among the other species of the genus *Ardea* are the Egrets, most of which have snowy-white plumage, with beautiful long crests and feathery plumes on the back during the breeding-season. More than one species has occurred in England, but they are much more plentiful in certain parts of the continent.

In Hungary large numbers of Herons and Egrets breed together in the marshes, Egrets and Night Herons (*Nycticorax griseus*) herding together with Common and Purple Herons. Landbeck

writes :—"The clamour in these breeding-places is so tremendous and singular in its character as almost to defy description ; it must be heard before a person can form any idea of what it is like. At a distance these hideous noises blend into a confused roar, so as in some way to resemble the hubbub caused by a party of drunken Hungarian peasants ; and it is only on a nearer approach that the separate notes of the two species, the Common and the Night Heron, can be easily distinguished, namely, *craik* and *quack*, to which the notes of the young, *zek-zek-zek*, or *gek-gek-gek*, &c., in different keys, serve as an accompaniment. When close to, the noise is tremendous, and the stench unbearable. This, together with the sight of dozens of young Herons in every stage of putrefaction and teeming with maggots, is perfectly sickening, though the contemplation of life and movement in this immense heronry is a matter of interest to the true ornithologist."

The tops of the highest trees are usually occupied by the nests of the Common Heron ; a little lower down is the habitation of the shy and beautiful Great Egret (*Egretta alba*) ; while among the forks of the lowest branches the Night Heron takes up her abode. All these species build in one and the same tree, the nests numbering not unfrequently as many as fifteen in a single tree, and yet peace invariably reigns between all these varieties. High over the trees appears the Common Heron, laden with booty, announcing his arrival with a hoarse *craaich*, when, changing his note to a goose-like *da-da-da-da*, he either jerks the provender down the throats of his ever-hungry youngsters, or throws it up before them, when the fish are greedily swallowed amid a desperate accompaniment of *gohé-é-é-é*, *gohé-é-é-é*, a sound much resembling the frantic cry of a calf which is being lifted into a farmer's market-cart. The conduct of the more cautious Egret is very different. Circling far above the nest, she first satisfies herself that no foe is hidden below before she alights amongst her family, which are much quieter and less hasty than their cousins. The Night Herons, on the contrary, approach their nests from all sides, high and low, their crops filled with frogs, fish, and insects. A deep *quák* or *gowek* announces the arrival of the old bird already from some distance, to which the young answer while feeding with a note resembling *queht*, *queht*, or *quehaoákeh*, *quehoehah*. As soon as the parents have taken their departure the youngsters recommence their concert, and from every nest uninterrupted cries of *tzik-tzik-tzik*, *tzék-tzék-tzek*, *tzgé-tzgé-tzgé*, and *gét-gét-gét*, are the order of the day. This amusement is varied by the nestlings climbing out among the branches till they reach the top of the tree, whence they can have a good look-out, and can see the old birds returning home from a long distance, though they are in many cases often mistaken as to their identity.

THE SECOND FAMILY OF THE HERODIONES.—THE STORKS (*Ciconiidae*).

These birds may be divided into two sub-families, the Umbres (*Scopinæ*) and the true Storks (*Ciconiine*). The first of these sub-families contains only two genera peculiar to Africa, each possessing a single species as its representative. The Umbre, or Brown Stork, is a bird of moderate size, with a totally brown plumage and a well-developed crest. Mr. Layard writes of it :—"The Hammer-kop (literally Hammer-head) is found throughout the Cape Colony, and all the way up to the Zambesi, frequenting ponds, marshes, rivers, and lakes. It is a strange weird bird, flitting about with great activity in the dusk of the evening, and preying upon frogs, small fish, &c. At times, when two or three are feeding in the same small pool, they will execute a singular dance, skipping round one another, opening and closing their wings, and performing strange antics. They breed on trees and rocky ledges, forming a huge structure of sticks, some of them of considerable thickness. These nests are so solid that they will bear the weight of a large, heavy man on the domed roof without collapsing. The entrance is a small hole, generally placed in the most inaccessible side." Mr. Layard also states that the bird embellishes his singular nest with brass and bone buttons, bits of crockery, bleached bones, or anything bright and glittering which it may pick up. One nest which he saw was three yards long, and one yard and a half across.

The *Balaniceps rex*, or Shoe-billed Stork, is less widely distributed than the Brown Stork in Africa, being only found in the waters of the Upper Nile, where he is very seldom met with, however. It is one of the largest birds known, and is unequalled among birds for its curious appearance. As to the distinctive birds of Central Africa, Dr. Brehm writes :—"A creature which resembles a very marvel of fairy-land—I mean *Balaniceps rex*, the Boot-bill, or Shoe-bill, as the Arab tribes of East Soudan call it—holds the first place among the characteristic birds of Africa : there is, in fact, only



THE SHOE-BILLED STORK.

one other species in Africa which is as remarkable as this—the Ostrich. It would indeed suffice if we were to take these two birds as types of Africa. One of them, the ‘new wonder of the desert, the camel of birds, a bird which flies on its legs and steers with its wings, a winged Giraffe, which affords the Arabs matter for a thousand fables;’ the other, ‘the wondrous guardian of the holy stream which shrouds its source in secrecy,’ in its origin a mystery, in itself a riddle. The sacred Ibis, no less a servant of the ancient god, added its long-established renown to the sacred stream. Legend has given the Boot-bill its celebrated name, a name as remarkable as the bird itself, which it has earned from the atmosphere of fable with which it is surrounded, owing to its fantastic form—‘the whale-head’ and ‘king!’—and verily with him the innermost and obscurest realm of the world is revealed.”*

The true Storks have not the hooked bills which distinguish the foregoing birds, and contain the Adjutants, the Open-bills (*Anastomus*), and the Wood Ibises (*Tantalus*). The White Stork (*Ciconia alba*) is a summer visitor to Europe, and is seldom found in England. In many parts of the continent, however, he is by no means uncommon, and wherever they occur they are protected by the peasants on whose houses they build, and the nests are regarded in many places as a protection from fire. The migration occurs during January and February, when the Stork arrives in his winter quarters in South Africa, passing by the Straits of Gibraltar in vast numbers, some of them, according to Colonel Irby, remaining to breed in Morocco. These are the first to depart south. During the autumn migration a great many stop to rest on their southward journey, and are seen in considerable numbers, being very tame, and often following close behind the plough. M. Favier states that the Moors believe that it offends God to kill these birds, in the same way as they believe that it pleases or soothes the evil one to kill the Raven. The White Storks, in common with Swallows, are supposed to be inspired by Allah to protect the harvest and the country from noxious insects and reptiles, and the birds themselves (knowing the benefits they confer on man) ask in return protection for their offspring by building their nests on the walls of towns and houses. Another Arab legend is that the Storks originate from a wicked Kadi and his family, who, as a punishment for their great cruelty, were all changed into these birds, and that these *miserables* humble themselves to appease Allah, and in the hope of some day regaining their original human form, pray without ceasing day and night, and, whenever they rest, prostrate themselves and clack their bills.

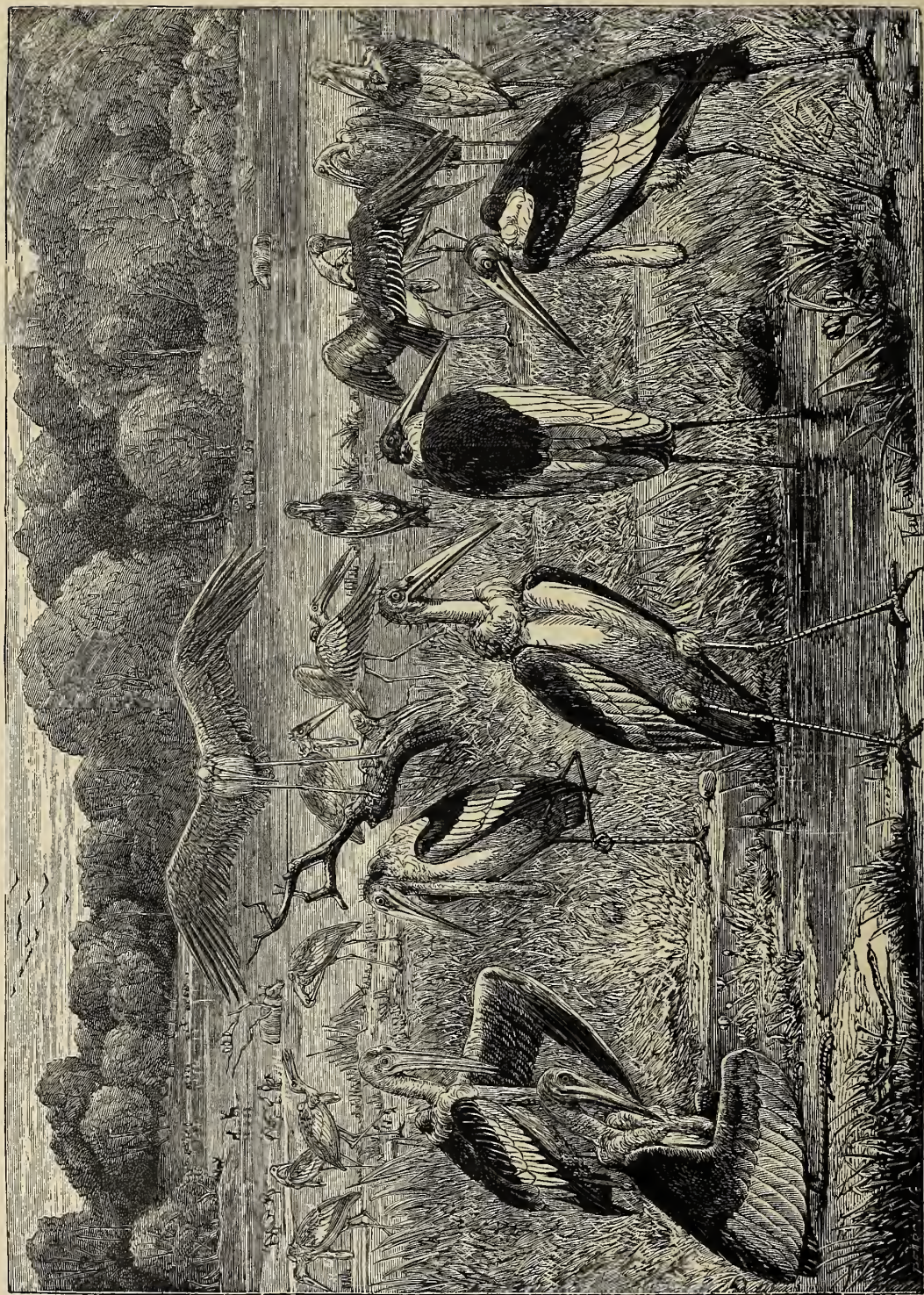
Colonel Irby says:—“On the African side of the Straits of Gibraltar, in many situations, the Storks breed on trees, generally in colonies, as well as on houses, but usually near villages, and almost every Moorish hovel has its Stork’s nest on the top, a pile of sticks lined with grass and palmetto-fibre. It usually contains four white eggs, which are very rarely marked with pink blotches; these are sometimes laid as early as the 25th of March, and are very good eating, either hot or cold. . . . I may here remark that Storks usually migrate in large flocks at a great height, with a gyrating flight. The earliest date of their arrival that I noticed near Gibraltar was on the 11th of January; and they nearly all leave by the end of September. Feeding on insects of all kinds—mice, snakes, and other reptiles—they are most useful birds, and certainly deserve the protection and encouragement which they receive in Morocco, where they are in consequence excessively tame. Their grotesque actions when resting, and their habit of continually clacking their bills together, making a noise like a rattle, render them very amusing to watch. I was informed by a Frenchman who had passed two years in the city of Morocco, that there, as well as at Fez, and some other large towns in the Moorish Empire, there is a regular Storks’ hospital, and that should one be in any way injured, or fall from the nest, it is sent to this institution, or rather, enclosure, which is kept up by subscription from wealthy Moors, who consider the Stork a sacred bird.”†

Of the Adjutant (*Leptoptilus argala*) an excellent account is given by Dr. Jerdon in his “Birds of India”:—“The pouch is sometimes sixteen inches and more in length. It has no connection with the gullet, but is probably connected with the respiratory system of the bird; and as Mr. Blyth suggested, is probably analogous to the air-cell attached to one lung only of the Python or Boa, and, as in that case, no doubt supplies oxygen to the lungs during protracted acts of deglutition. It appears to increase in size with the age of the bird.

“The Adjutant is found throughout the greater part of India, is rare in the South, but extremely

* “Bird Life,” p. 192.

† “Birds of Gibraltar,” p. 189.



ADJUTANTS.

common in part of Northern India, and more especially in Bengal and North-eastern India. I never saw it in the Carnatic, nor in Malabar; it is occasionally met with in Mysore, and is not rare in Hyderabad, thence becoming more common and abundant northwards. It spreads through Burmah to the Malayan peninsula. It is only a temporary resident in India, coming in towards the close of the hot weather in April or May, and remaining till October. A very few barren or unpaired birds remain occasionally in parts of the country. In Calcutta, and some other large towns, the Adjutant is a familiar bird, unscared by the near approach of man or dog, and protected in some cases by law. It is an efficient scavenger, attending the neighbourhood of slaughter-houses, and especially the burning grounds of the Hindoos, where the often half-burnt carcasses are thrown into the rivers. It also diligently looks over the heaps of refuse and offal thrown out in the streets to await the arrival of the scavengers' carts, where it may be seen in company with dogs, kites, and crows. It likes to vary its food, however, and may often be seen searching ditches, pools of water, and tanks for frogs and fish. In the Deccan it soars to an immense height in the air along with Vultures, ready to descend on any carcass that may be discovered. After it has satisfied the cravings of its appetite, the Adjutant reposes during the heat of the day, sometimes on the tops of houses, and now and then on trees, and frequently on the ground, resting often on the whole leg (tarsus). The Adjutant occasionally may seize a crow or a myna, or even, as related, a small cat; but these are rare bits for it, and indeed it has not the opportunity in general of indulging its taste for living birds, notwithstanding Cuvier's statement, 'that its large beak enables it to capture birds on the wing.' Dr. Jerdon then mentions a description published in 1861 of an Adjutant swallowing a crow, the author of which account stated that he, "saw it pass into the sienna-toned pouch of the gaunt avenger. He who writes saw it done." Again, wrote this same observer, "The Adjutant's cry very much resembles water flowing from a narrow-necked bottle, and he invariably utters it when about to swallow a piece of offal." "These utterly unfounded statements" called up Mr. Blyth in the "Ibis," Vol. iii, p. 268, who showed that both the passing of the crow into the pouch, and the call of the Adjutant, were simply impossible, in consequence of structural peculiarities. The Adjutant breeds in trees, on rocky cliffs, occasionally, it is said, in lofty trees away from hills. The neighbourhood of Moulmein is one of the best-known localities. The nests were found by Colonel Tickell on trees near the summit of some of the remarkable limestone rocky hills near that place. Captain Sparks had previously found the nest in the same locality; and Mr. Frith found them breeding in the south-east part of the Sunderbunds. The Adjutant lays two white eggs, and the young are covered with white down.



THE WHITE STORK.

"The feathers, known as marabon, or Comercolly feathers, and sold in Calcutta, are the under tail-coverts of this and another species [the Marabou Stork]. There is a popular superstition that if you split the head of this bird before death, you will extract from it the celebrated stone called Zahir mora, or poison killer, of great virtue and repute as an antidote to all kinds of poison."

THE THIRD FAMILY OF THE HERODIONES.—THE SPOONBILLS AND IBISES (*Platolidae*).

Although in outward appearance, at least, as far as their bills are concerned, the two groups of the Spoonbills and Ibises appear so different, yet they are closely allied on anatomical grounds, and

are to be considered as forming one family only. They may, however, be divided into two sub-families, as follows :—

THE FIRST SUB-FAMILY OF THE PLATALEIDÆ.—THE SPOONBILLS (*Plataleine*).

The extraordinary bill separates these birds from all their near allies. It is long and flat, widening out at the tip in a spoon-shaped apex, whence the birds derive their name. Only half a



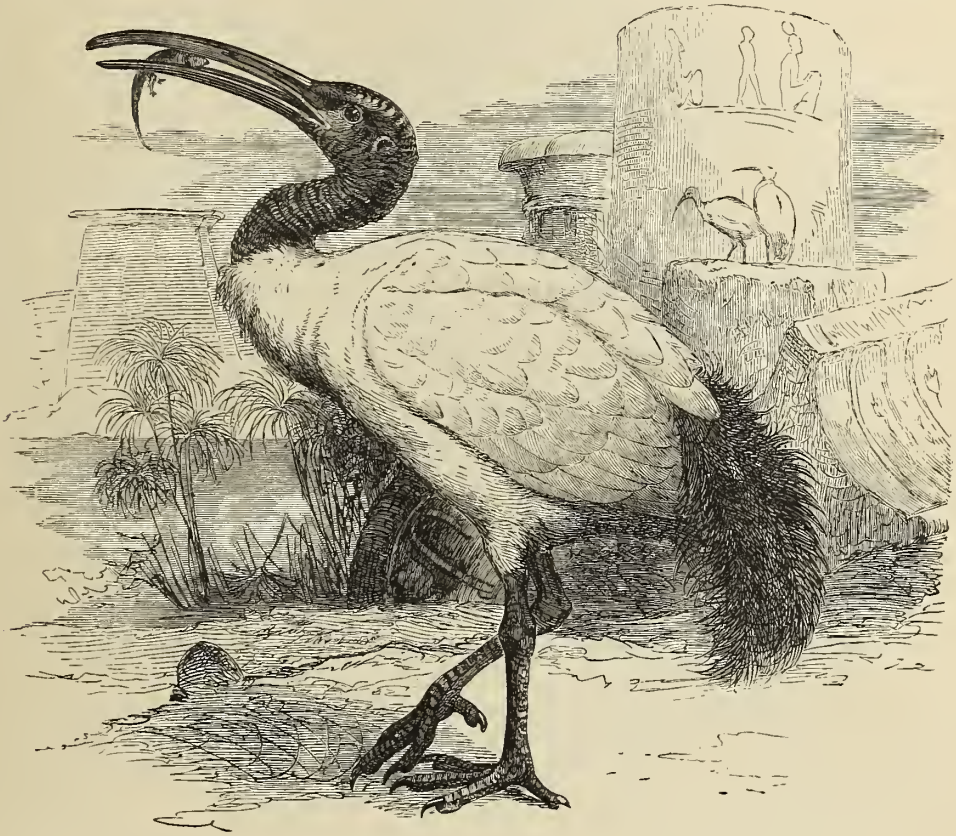
THE SPOONBILL.

dozen species of Spoonbills are known to science, but the genus occurs in every quarter of the globe, excepting in the northern parts. Thus, it is not found in the north of Europe, and only in the southern states of North America. The Spoonbill comes to England now only as a straggling visitor, but was formerly more plentiful. It has, doubtless, retired on the draining of the fens, which rendered it difficult to find sufficiently suitable breeding-places. In Holland it still nests, though even there it is becoming rarer, as the lakes become drained. In certain places it is known to breed in lofty trees, but in Holland it nests on the ground among reed-beds, and an interesting account is given by Dr. Sclater and Mr. Forbes of a visit paid by them to a large mere called the "Horster Meer," between Utrecht and Amsterdam. The lake is farmed out at a considerable rent for the sake of the fish, reeds,

and eggs obtained there, and the nests of the Cormorants and Spoonbills are robbed systematically twice a week during the months of May and June. After that time they are left to hatch out their eggs. Several thousand nests of the Spoonbill were said to be in different parts of the mere at the time of the visit of the above-named gentlemen, and all those that they examined were simply flattened surfaces of broken reed, not elevated more than two or three inches above the level of the swamp. The eggs are white with a few pink or brown spots.

THE SECOND SUB-FAMILY OF THE PLATALEIDÆ.—THE IBISES (*Ibidinæ*).

As before mentioned the Ibises, though closely related to the flat-beaked Spoonbills, differ greatly from them in the form of the bill, which is curved like that of a Curlew. They are, moreover, more



THE SACRED IBIS.

numerous than the members of the preceding sub-family, about thirty species being known. These are found everywhere, excepting in the extreme north, some kinds being resident, whilst others are migratory. Some of the Ibises are very picturesque in colour, and the Scarlet Ibis (*Ibis rubra*) of South America is really a beautiful bird. The Glossy Ibis (*Falcinellus igneus*), which has occurred on rare occasions in Africa, is one of the most cosmopolitan of birds, being found in the greater part of the Old World and the New. The most interesting species, however, of this genus is, no doubt, the Sacred Ibis (*Ibis religiosa*), which is so well known to us as the bird worshipped by the ancient Egyptians, and so often figured on their monuments. It was to them the harbinger of the spring, and heralded the approach of the fruitful season. Brehm writes:—"Birds are perfectly aware that they can implicitly trust the Arab. No young scamp ever thinks of robbing their nest; no sportsman is lying in wait near their bower to kill the newly-fledged youngsters. In the eyes of the Arab, the naturalist, even, who only destroys an occasional pair

of birds, or takes an egg or two for the purposes of science, is not held to be excused. They have often called down the curse of heaven upon my head for so doing; and, indeed, my brown servants used to tremble for me, as they said that the curse was bound to take effect. I never abused them in return, for I could not but admire the feelings which inspired them on those occasions, sentiments so noble, and so deeply founded, that I have always dreaded the curse, despite of myself.

"In former days it may possibly have been thus in all countries. In those days all birds were loved and cherished by man, some being, indeed, regarded by him as sacred. He saw connected with their appearance and departure those various phenomena of nature which took place the year round, and whose changes, &c., they did not then understand; he regarded the arrival of the migratory visitors with holy awe, as though the Deity Himself had appeared. In this manner the Egyptians held the Ibis to be sacred. When the Nile, after being at its lowest ebb, rose again, and the water assumed a red tinge, then the Ibis appeared in the land of the Pharaohs as sure guarantee that the stream—the giver and preserver of life, which the people in their profound reverence raised to the rank of a god—would once again empty the well-spring of plenty over the thirsty land. The servant and messenger of this all-bounteous Deity commanded of necessity a reverence of a poetic and distinguished character, by reason of its importance: he, too, must also be a god! How beautiful, intelligent, and simple was this messenger! The Ibis is one of the most amiable and winning birds I have ever met with. It associates of its own accord so much with man that the trouble of taming the bird is but slight, and takes place almost without any advances on the part of the former. This the ancient Egyptians were fully aware of, for we find that they read the great book of nature with intelligence and care, and it is owing to this that they deified the bird. On this account its remains were preserved by their priests from decay, and kept for thousands of years, until the spirit, suffered by permission of an All-wise God to wander in space, should return to its earthly tenement. Like the human body, that of the bird was embalmed in the same spices in which the mortal remains of kings had been preserved from the ravages of time; and like them, over the sarcophagus a heap of stones was raised as a monument to the bird. One of the pyramids, Sakkara, is dedicated to the Ibis.

"Now, the Ibis is no longer venerated; the sacred bird has sunk to the rank of an ordinary mortal. Isis and Osiris have been supplanted by the Crescent and the Cross; and with the ancient gods vanished Thot, their celestial messenger. He no longer appears in Egypt to announce to the people the rising of the sacred waters; they believe no longer in his mission. He lives retired far up the mighty stream, 'who hides his source,' as though he felt called upon to watch the veil behind which the origin of the ancient god lies hidden to this day. He lives, however, a thousand times over in the splendid remains of a mighty past. His form stands out clearly among the hieroglyphics of the sacred writings, and thousands of years hence the porphyry will bear his image, so long confided to its care." What Dr. Brehm says about the Sacred Ibis not now occurring in Egypt is quite true, as it is only a rare and occasional straggler to that country, though it is plentiful in other parts of Africa.

THE FOURTH FAMILY OF THE HERODIONES.—THE FLAMINGOES (*Phanicopteridæ*).

These curious birds are often placed with the *Anatidæ*, or Ducks, with which their internal anatomy allies them, but in their osteology they are intermediate between the *Anseres* and the Storks and Herons, to which they also show an approach in their extremely long legs. The neck of the Flamingo is very long, and the bill is quite peculiar.

About eight species of Flamingo are known to science, and they are found in most of the temperate and tropical portions of both the Old and New Worlds, but do not occur in the Australian region, nor in the northern parts of either hemisphere. One species (*P. andinus*) is only known to inhabit the Chilian Andes, and appears to be a mountain species. Many of the others have tolerably wide ranges, and all appear to frequent the same kind of haunts, affecting marshes and shallow lakes. The European Flamingo (*Phenicopterus antiquorum*) is a migrant to Southern Europe, arriving as early as February, though the principal flights take place in April, May, and

June, and the females come before the males. The return migration occurs in the late autumn. As a rule they prefer brackish lagoons and salt-water lakes in the vicinity of the sea-coast, and seldom frequent fresh-water lakes. In deep water they swim, their toes being webbed like those of a duck, but ordinarily they wade out in the water to a suitable depth, and then bend down their long necks to rake the bottom for food. The upper mandible is plunged downwards into the mud, and the tongue is busily occupied during the progress of feeding rejecting what is not good for food, the refuse being drained through the sieve-like apparatus on the bird's bill. The breeding habits of the Flamingo are curious, and are described by Mr. Howard Saunders in his paper on the "Birds of Southern Spain" as follows:—"The Flamingo always makes its nest in the flattest part of the



THE FLAMINGO.

marsh, in places where there is from three to four inches of water. The nest, which rises to about half a yard above the surface of the water, is made of mud, like that of a Swallow. Its shape is almost cylindrical, but somewhat wider at the base. There is a slight concavity for the eggs, oval in shape, like that of the inside of a hat. When the bird is sitting she has her legs stretched out behind, hanging in the air (that is to say, unsupported) like the arms of a man when he puts them behind his back and throws his shoulders forward. The complement of eggs is five, and the birds, when once frightened from their nests, do not return. To raise itself, the bird 'scrambles' with its feet on the side of the nest till it lifts its body clear, and then takes wing."

THE EIGHTH ORDER OF BIRDS.—THE GEESE AND WILD FOWL (*Anseres*).

The present order is a large one, and though nominally called the Geese, from the fact of the genus *Anser* giving its name to the order, it contains by far the larger number of web-footed birds, all the Ducks, Geese, and Swans being included within its limits. The order *Anseres* contains two families, the *Palamedeidae*, or Screamers, and the *Anatidae*, or Ducks.

THE FIRST FAMILY OF THE ANSERES.—THE SCREAMERS (*Palamedeidae*).

These singular birds are natives of South America, and are only three in number, the Horned Screamer (*Palamedea cornuta*), from Guiana; the Crested Screamer (*Chauna chavaria*), from Southern Brazil and Paraguay; and the Derbian Screamer (*Chauna derbiana*), from Columbia. They have a horn on the forehead, and very powerful spurs on the wings, and these are of great assistance to the birds in defending themselves and their young from the attacks of birds of prey. As a rule, however, their habits are gentle and shy, but they fly with great power, owing to their broad and powerful wings. The Crested Screamer is said to be domesticated by the natives, and goes about with the poultry, being, from its large bulk and formidable wings, a very able defender of the latter birds.

THE SECOND FAMILY OF THE ANSERES.—THE WILD FOWL (*Anatidae*).

In this group, containing the Ducks, Geese, and Swans, the feet are very short, and the tarsus is always strongly reticulated in front; the bill is almost straight or, at the most, gently curved, and the tip is convex and rounded at the extremity, in many of the species forming a conspicuous knob, like a finger-nail. The hind-toe, which is present in all, is small, and does not touch the ground. The sides of the face also generally present an angular appearance, having a triangular patch of feathers placed between two bare spaces. The family may be further divided into groups, the Geese, the Swans, the true Ducks, the Scoters and Eider-Ducks, the Mergansers, and the Diving Ducks.



THE BLACK SWAN.

In the first group, the GEESE, the hind-toe is simple, and the bill is deep, with a very conspicuous "nail" at the end. Many of the Geese are very remarkable in form, especially the Dwarf Geese (*Nettapus*), which do not exceed a foot in length, and are found in Africa, India, and Australia. Another curious bird is the Cereopsis Goose (*Cereopsis novæ hollandiæ*) of Australia, which used to be plentiful in the islands of Bass's Strait, but is fast becoming rarer, owing to its unwillingness to fly. The earlier voyagers recount their having killed numbers of these birds with sticks, and the flight of the Cereopsis Goose is described as being remarkably heavy, and performed with difficulty. Its nearest ally, the extinct Goose of New Zealand (*Cnemiornis*), appears to have been altogether incapable of flight. In captivity the disposition of the male bird is most pugnacious, and it is



THE SUMMER, OR WOOD DUCK.

necessary to keep them apart from other birds, as they will attack and kill any bird within their reach, even species as large as Cranes. In their fighting propensities they resemble the Spur-winged Geese (*Plectropterus*) of Africa, which have a warty excrescence on the face when adult, and powerful spurs on the wings. The majority of the Geese, however, remain in the genera *Anser* and *Brenthus*. Of the former genus several species visit England, passing to the extreme north to breed. From the Grey or Wild Goose (*Anser anser*, Linnaeus) the Domestic Goose is supposed to be descended. The Sea Geese (*Brenthus*) are smaller birds and of more compact build, as well as rather more variegated plumage, the Red-breasted Goose (*B. ruficollis*) being a really handsome bird. The Sea Geese resort to the most northern regions to breed, and the Brent Goose (*Brenthus bernicla*) was found by Captain Feilden nesting on the shores of the Polar basin. It is also the most common species in England in winter, occurring in large numbers on some of the tidal harbours and estuaries. Several species of Brent Geese occur in South America, and are very handsome birds, the males and females differing conspicuously in plumage.

In the second group of the Wild-fowl are the SWANS (*Cygnus*), remarkable for their extremely long necks, which exceed the length of the whole body. Their short legs, which are placed rather far backwards, render the Swan's movements on land awkward and ungainly, but in the water their motions are graceful in the extreme. Their food consists of vegetable substances and weed, which they search for under the water, their long necks enabling them to dip down below the surface and to reach their food at considerable depths. In most of the Swans the windpipe enters the bony portion of the sternum, and performs several evolutions before passing to the thorax. The Whooper, or Wild Swan, visits England in the winter, when it is frequently killed both on the sea-coast and inland. On the tidal harbours of the south coast it consorts with Brent Geese and Ducks, and several are often obtained by a successful sportsman with a punt gun. The Swans breed in high latitudes, but the tame species which frequents our rivers and lakes breeds on the eyots and shores, and makes a very large nest on the land, in which sometimes as many as six eggs are deposited. The latter are of large size and of a greenish colour. When the young are hatched they are covered with a greyish down, and both parents display great affection for their offspring, the males being particularly pugnacious, and driving off any intruder who may approach their domain. They fight with their wings, with which they deal tremendous blows, often breaking the wing of their adversary. In Australia a peculiar species occurs, the Black Swan (*Cygnus atratus*), but perhaps the handsomest of the genus is the Black-necked Swan (*Cygnus nigricollis*) of Antarctic America. Both these southern species show a marked contrast to the northern Swans, which are white when adult.

In the next group occur the true Ducks, of which the Common Wild Duck (*Anas boschas*) is the type. This well-known species is one of the most widely distributed of this wide-ranging family, for it occurs not only all over the northern portion of the Old World, extending to China and Japan, but it is also met with in North America, as far south as Mexico. The Wild Duck breeds in many parts of the United Kingdom, and where not disturbed does not betray any great fear of man. The nest is placed on the ground, often at some distance from the water, and in one instance the writer remembers having come across a Duck sitting on nine eggs at least half a mile from the lake where numbers of others were breeding. It is strange that the sitting bird should expose her young brood, even if they should be safely hatched, to the risk of capture by a fox or other wild animal on their way to the water. The nest in question was placed in a small wooded dell, and was overhung by a bush, which would have effectually concealed it had not the old bird betrayed its presence by flying off. The Mallard is a much more handsome bird than the Duck, and both sexes closely resemble the common Duck of the farmyard. In summer, however, the male bird loses its rich plumage, and dons a dress like the female, only resuming its beautiful colours again in August. A good decoy, where many Wild Ducks are to be seen, is often a pretty sight, the birds swimming about in pairs, when the fine plumage of the male contrasts with the more sober colour of his mate. At times they may be seen tail uppermost, searching below the surface for their food, which consists of worms, grass-seeds and roots, mollusca, insects, small reptiles, and little fish. On being approached they fly off with a sonorous quack, that of the female being the louder. During the breeding season the males consort much together, and on taking flight mount high in the air and circle round some distance before again settling down. The female evinces great attachment to the young, and may often be seen attended by her little brood, who on the approach of danger manage to conceal themselves most adroitly, while the mother will feign lameness, or pretend to be wounded, in order to draw away the intruder from the whereabouts of her brood. In the same group as the Wild Duck are also contained the Sheldrakes, Shovellers, and the Teal, besides several other genera.

In the fourth group of the Ducks are the SCOTERS (*Edemia*) and EIDERS (*Somateria*), etc., which have the hind toe lobed, and the same peculiarity of the hind toe exists also in the next group, the MERGANSERS. In the latter birds the bill is very long, and more slender than in the other groups. They are mostly birds of northern regions, occurring in both the Old World and the New; and two species, the Goosander (*Mergus castor*) and the Red-breasted Merganser (*Mergus serrator*), breed in the north of Scotland, though they occur more frequently in winter, at which season they are shot, not only on the harbours of the coast, but also on inland lakes and rivers. Both species are migratory, visiting India in the winter, but in the Southern Ocean there is one species (*Mergus australis*) which has as yet only been met with in the Auckland Islands. The beautiful Smew (*Mergellus*

albellus) is also one of the Merganser group, and has much the same habits and range as the before-mentioned species, ranging, like them, into India in winter, and passing the summer in the northern parts of the Old and the New Worlds. The genus *Merganetta* also belongs to the group, and contains three species of beautiful coloration, confined to the Andes of Chili and Peru and the high ranges of Ecuador.

The last group of the Wild-fowl contains the STIFF-TAILED DUCKS, which are recognisable by their extremely rigid tail-feathers, which are narrow and pointed, and are not covered at the base by the upper tail-coverts. The tail-feathers in some species attain to the number of twenty-four. The hind toe is lobed. As a rule these Ducks are not so much inhabitants of the northern portions of the globe as were the preceding members of the sub-family, but are found in the more temperate and warmer climates, especially in the southern regions of the world; they are also more strictly inhabitants of lakes. One species, the White-headed Duck (*Erismatura leucocephala*), occurs in South-Eastern Europe and Northern Africa, and is stated to be an expert diver, seldom taking to its wings, and when flying appearing more like a Diver than a Duck, the wings producing a very audible whirring sound as they progress through the air. Perhaps the most remarkable of all the Diving Ducks is the great *Biziura lobata* of Australia, the male of which has a large lobe of skin hanging down under the chin, the female being of only half the bulk of the male.

THE NINTH ORDER OF BIRDS.—THE PELICANS (STEGANOPODES).

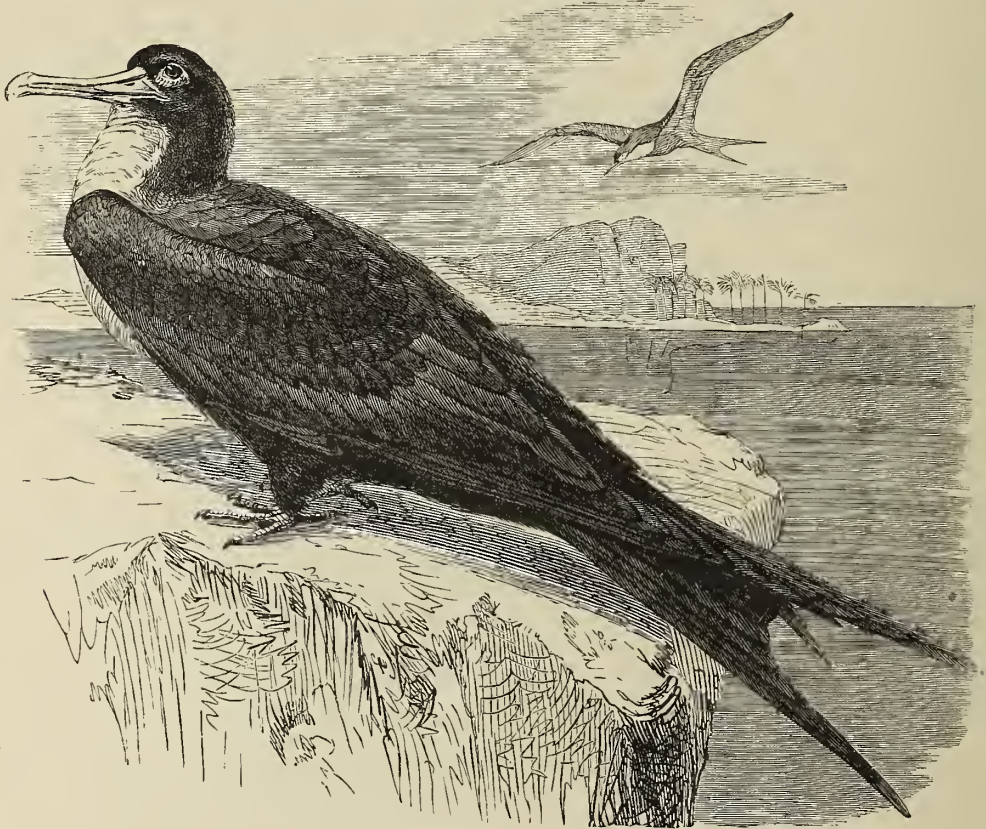
Under the heading of the Pelicans not only the latter birds are included, but also all the Cormorants, Frigate Birds, and Tropic Birds. They form three families, and are all of them distinctly recognisable by the form of the feet, all the toes being united by a web, which joins the hind toe as well as the three front ones. In this respect they differ from the Ducks, and Gulls, and other swimming birds.

THE FIRST FAMILY OF THE STEGANOPODES.—THE FRIGATE BIRDS (*Fregatidæ*).

The Frigate Birds, or Man-of-War Birds, as they are also called, are inhabitants of the tropical ocean, ranging far south, but not occurring in northern latitudes. The tail is very long and forked, the bill powerful and hooked, so that by some ornithologists they have been considered to be not distantly related to the birds of prey. Their flight is most airy and buoyant, and the rapidity with which they fly is extraordinary. They are robbers in every sense of the word, following up the more pacific Terns and Gannets, and forcing them to disgorge the fish they have captured with so much patience, pursuing them in mid-air, and dexterously catching the fish as the frightened quarry lets it fall. Audubon states that he believes the Frigate Bird to be possessed of the most powerful flight of any known bird, and he relates having seen one of them pursue a Cayenne Tern and force the latter to let go of a fish it had captured. The latter was about eight inches in length, and had been seized by the robber in a manner inconvenient to swallow. It therefore mounted about a hundred yards, let the fish fall and caught it again, but then not satisfactorily, and it again dropped it, reclaiming it, however, before it had fallen many yards, when he at last managed to catch it conveniently, head foremost, and gulped it down. The Frigate Birds apparently always build in rookeries on trees, and Mr. G. Cavendish Taylor has published an account of his visit to one of these breeding-places off the coast of Honduras:—

“On the 1st of January, 1858, we went off in a boat, with four rowers, to visit an island some four or five miles from Tigré Island, in the Bay of Fonseca, on the Pacific coast of Honduras. It is called Bird Island, and is not more than an acre in extent, and of an oblong shape. At one end the beach is sandy, and at low water one can walk across to another island close adjoining. At the other end the shore is rocky, and it is much the same at the sides, the beach being strewn with large volcanic stones. The surface of the island is some thirty or forty feet above the sea level. It is covered with long grass, and there are also a few trees and low shrubs—mangroves (*Rhizophora mangle*, Linnæus)—growing in places, especially about high-water mark. At a distance the most conspicuous object was a numerous flight of Frigate Birds soaring over the island. As we approached, large white patches, caused by the droppings of the birds, became visible. We landed on the flat sandy beach, and in a few minutes I had shot a pair of Tiger-Bitterns (*Tigrisoma tigrinum*), which allowed me to approach without any difficulty. Besides these and the Frigate Birds we saw no birds on the island, except a few Pelicans,

some large Accipitres, and a single Booby (*Sula fusca*), which had its nest on a low tree in company with the Frigate Birds. The whole island was appropriated by the latter. Nearly every tree and bush, both high and low, was covered with birds and their nests. The latter were mostly composed of a few sticks laid crossways, hardly as much in quantity as in the nest of the Ring Dove (*Columba palumbus*). Each nest contained a single egg, about the size of a hen's egg, and of a chalky whiteness. We brought away nearly a hundred of them. Some were quite fresh, and others had been sat upon some days. Although the nests were upon low bushes, still they were placed just too high for one to reach the eggs without climbing. Many of the nests were on the mangrove bushes which were growing just above high-water mark, so that we could see into them when standing on the bank of the island,



THE FRIGATE BIRD.

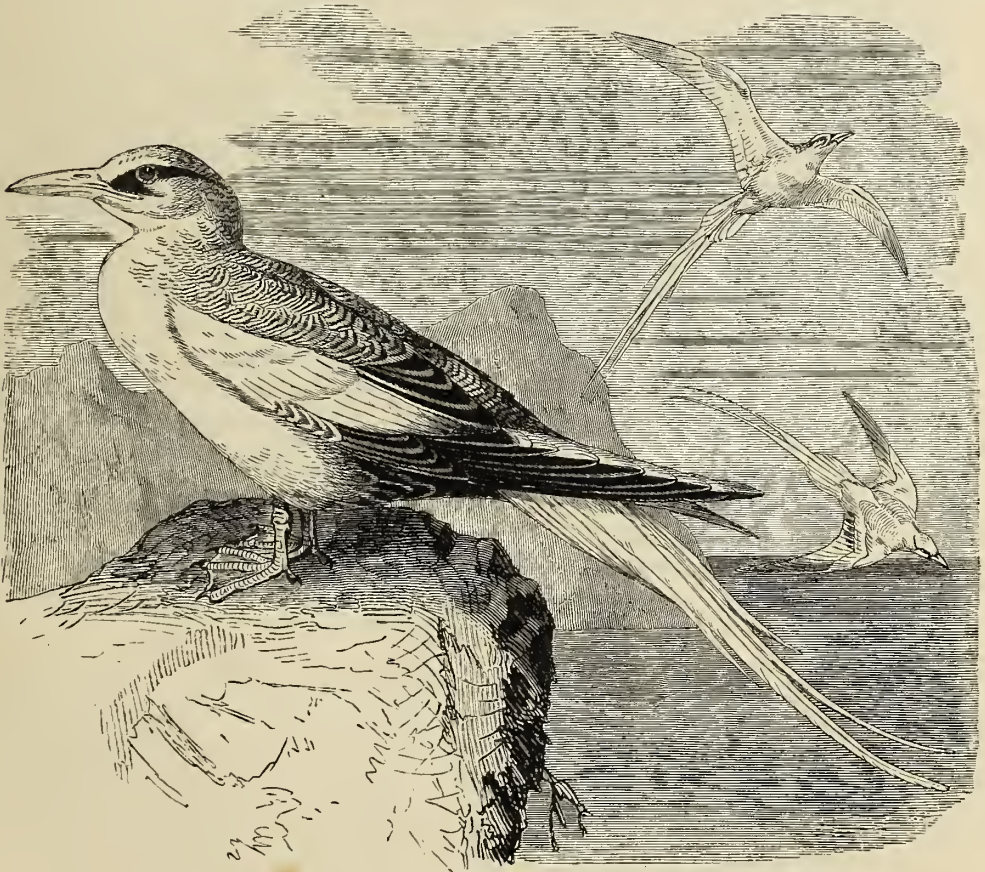
which was at a higher level. Some of the birds were sitting on their nests, and others were perched upon the branches. By firing into the mass I might have killed a dozen at a shot, but shooting would have been an absurdity, for I could have obtained any number with a stick. The difficulty was to get them off their nests. Shouting had little or no effect; and even the report of a gun would only raise a few, who would frequently settle again on the bushes. I threw some stones among them, without producing much result, and even tried to poke them off their nests with my gun; but they merely snapped their beaks at me in retaliation. All this time there were thousands of other birds soaring in the air a little way over our heads. I observed that the Frigate Birds were of three different plumages. As there were birds of all three sorts sitting together, and with their nests in the same bushes, I concluded that they were of one and the same species—males, females, and immature birds. Some have the head and neck white, the beak white, the feet and legs bluish-white, the belly white, and the wing-coverts greyish-brown. Others have the legs and feet black, and are black all over, with a greenish metallic tinge on the black. These have a bright scarlet pouch, which they inflate to the size of an Ostrich's egg

while on the wing. The boatmen informed me that these were the male birds. Others, probably immature birds, had the head black, the throat white, and the legs and feet pink. All had long black forked tails. I obtained a specimen of each, but did not preserve them, as I had much to do; and besides, they are stinking birds to handle, as bad as, or worse than, the Turkey-Buzzard (*Cathartes*). The Pelicans have also a breeding-place in Fonseca Bay, but it is in an island at some distance from the one in possession of the Frigate Birds."

In the Ellice Islands, the Rev. S. G. Whitmee states that the birds are domesticated by the natives, and when he was in those islands in 1870 he saw scores of them about the villages, sitting on long perches erected for them near the beach. The natives procure the young birds and tie them by the leg and feed them till they are tame. Afterwards they let them loose, and they go out to sea to get their food, and return to their perches in the villages. The same gentleman also informed the writer that recently a post had been established between some of the islands by the missionaries, much after the fashion of Carrier Pigeons in our own country, and Mr. Whitmee had himself seen more than one letter arrive in a quill attached to the bird.

THE SECOND FAMILY OF THE STEGANOPODES.—THE TROPIC BIRDS (*Phaethontidæ*).

These birds, more familiarly known to mariners as "Bo'suns," are inhabitants of the centre of the ocean between the tropics, and are generally observed following in the wake of vessels. From their white plumage they have much the aspect of Sea Swallows, which they also resemble in their flight. They may, however, be distinguished by the two long central tail-feathers, which in one of the three species known are red, in the other two white. Mr. Hume describes the Tropic Birds as not uncommon in the northern portion of the Indian Ocean. They flew about the ship much like



THE TROPIC BIRD.

Terns, with their longish bills pointed downwards after the manner of the Caspian Tern. They seemed totally fearless, and were in fact attracted to the vessel by guns which were fired at other birds; but they did not come very close, not nearer than seventy or eighty yards as a rule, but they flew round and round at this distance for some time. They were in small parties of ten or twenty in number. Mr. Penrose, writing on birds from the island of Ascension, states that all these species of Tropic Birds, and some other sea-birds, such as the smaller Skuas, are familiarly called Boatswain Birds by the sailors, owing to the resemblance of the projecting tail-feathers to a marling-spike. The Tropic Birds feed principally on crabs, and they breed on a little island lying off the eastern coast of Ascension, named "Boatswain Bird Island," nesting in holes in its sides, and laying only one egg. Curiously enough, the male and female are found sitting in their holes side by side, with their heads inwards; and as soon as one has been drawn out it begins to use its beak to considerable purpose. Two species of *Phaethon* nest on this small island.

THE THIRD FAMILY OF THE STEGANOPODES.—THE PELICANS (*Pelecanidae*).

Besides the true Pelicans the present family contains the Gannets (*Sula*), the Darters (*Plotus*), and the Cormorants (*Phalacrocorax*). The Common Gannet (*Sula bassana*) gets its specific name from its historical association with the Bass Rock, which is one of its well-known breeding-places. The number of birds which frequent that locality is prodigious, and Mr. Seeböhm tells us that when he visited the Rock he found every available ledge on the steep side occupied with a nest. In fact, it overflows with them, and on the top a number of nests are placed for which there is literally no room on the ledges of the cliffs. Among these nests a person may walk, and in many cases push the birds off them. The nest, according to Mr. Seeböhm, is made of sea-weed, and is very similar to that of the Cormorant. He never saw more than one egg, which resembled that of the last-named bird, but was perhaps twice the bulk. Looking down the cliff on to the myriads of birds flying in every direction reminds the observer at once of a snow-storm. The young are almost black when first hatched, but are afterwards covered with a white down. For the first year they are of a dark grey colour, afterwards mottled, but it is not until the fifth year that they attain their white plumage and commence to breed. They come to the Bass Rock in the early part of March, remaining till October, and sometimes till November. In the winter only stray birds are seen, and these are very wild. When the Gannet leaves the shores of England in the winter it is seen in large quantities in the Straits of Gibraltar. Colonel Irby states that he has seen them close to the Rock of Gibraltar in large numbers, where, according to the wind, they might be noticed fishing on the leeward side of the rock, particularly close to Gibraltar, and many a time he has watched them darting down from a considerable height on their prey, often disappearing quite under the water. On the wing, to an experienced observer, they look like a large Gull. The earliest dates on which he observed this species near Gibraltar were on the 11th of November, 1870, and the 12th of October, 1871, while in the spring he saw them as late as the 28th of March.

In the typical Gannets, such as the European bird just noticed, the throat is feathered, with a naked line in the middle, but there are several small species frequenting the tropical and southern oceans which have the throat bare, as well as the whole of the face, and belong to the sub-genus *Dysporus*. They also frequent islands, and an interesting account is given by Mr. Osbert Salvin in his paper on the Sea-birds of British Honduras, of a visit paid by him in 1862 to the cays off the last-named coast:—

"The northern end of Half-moon Cay, which is long, and shaped as its name implies, is occupied by the pilots, who have their houses scattered about under a grove of cocoa-nuts. There are but few mangroves, but the southern portion, as well as nearly the whole windward side, is covered by low 'bush.' A large colony of Boobies (*Sula piscator*) hold entire possession of this portion of the island, every tree having four or five nests in it. By the time we had made acquaintance with some of the pilots, and had taken a 'long drink' of cocoa-nut milk (a luxury after the stale water we had had to put up with on board the schooner), it was mid-day, yet we made our way through the trees to search for Boobies' eggs. The sky was clear and the heat intense, the sea-breeze not yet blowing with any force, and the foliage not being thick enough to afford much

shelter from the scorching rays of the sun. The Boobies, too, seemed affected by the heat, and sat panting with open beaks; some, still more overcome, were resting against a branch, with their heads hanging down and eyes shut. At first I thought these were dead, but on stirring them up, I succeeded in making them open their eyes. I could not, however, prevail upon them to get up; they only screwed their heads about with a sort of expression that seemed to ask me what I meant. Over many of the nests one of the old birds sat, and in the same trees the fully-fledged young still remained.



THE DARTER, OR SNAKE-NECK.

The young were of every age, their plumage including every stage, from the white down of the newly-hatched chick to the grey dress of the full-grown. In some few, still older, the white dress of the adult was beginning to show itself. The name Booby is most appropriate: I never saw a bird with less idea of getting out of one's way, or caring less for what one did. Walking about under the trees was nothing; they hardly condescended to look down; nor when we stirred them up while taking a 'siesta,' pulled their tails, poked them off their nests, and fought with them for their eggs, and bullied them in every way, did we succeed in getting up any sort of excitement in the colony. They took everything with the greatest indifference, with a complaisant, grave expression that was laughable to watch. And yet a Booby is no fool at fishing. Rare sport they must have of it, flying at the pace

they do, and taking such headers. It was too hot to climb to every nest within reach ; and after trying a few, we found that there was always a chance of an egg in a nest upon which, and not near which, an old bird sat. Even in this way, after a long search, we only secured four rotten eggs. A few Man-of-War Birds breed in the same trees, nearly all of which had eggs. This Booby makes a nest very like that of a Man-of-War Bird, *i.e.*, of twigs rather untidily laid together in a convenient



THE CORMORANT.

fork in the top of a tree. I could not easily calculate the number of birds in this colony, but there were certainly several thousands."

The Darters (*Plotus*) are only four in number, and are inhabitants of the tropical and southern portions of both hemispheres, never occurring in the northern parts. One species inhabits South America, another Africa, a third India and the Malay countries, and a fourth Australia. They are also called Snake-necks, from the habit they have of swimming with the body submerged and only the neck exposed above the water, so that they really look not unlike a snake coming along. They are on this account not very easy to shoot, as their long thin necks offer a very indifferent target. They inhabit fresh water, and are not shy in districts where they have been unmolested.

The Cormorants (*Phalacrocorax*) are a much larger group than the Snake-necks, and are found all over the world, some of them being very large, while others are quite small and of elegant form. Many of the Cormorants are ornamented with a somewhat metallic plumage,

whilst not a few in the breeding season have some distinctive addition to their dress, either in the shape of a fine crest or wattles on the face. Our own species, for instance (*P. carbo*), has, when in full plumage, not only a crest, but exhibits a white patch on the lower flanks, and some white filamentous plumes on the neck. Mr. Seebohm allows us to make the following extract from his unpublished journal of a visit to the Fern Islands, off the Northumberland coast. He writes:—"The next island which we visited was that in which the Cormorants had established their colony. It consisted of an irregular reef of rocks rising on one side of the island somewhat abruptly out of the sea, to the height of ten or twenty feet, and sloping away into the sea on the other side with a rocky, shingly shore. As we neared the island we could see the weird-looking birds standing, some on the rock and some on the edge of their nests, stretching out their long snake-like necks, and evidently becoming alarmed at the approach of our boat. Before we got near enough to land they took wing, and retired to a distant part of the island, one old female, apparently the grandmother of them all, being the last to leave. The whole of the surface of the rocks was covered with the dung of the birds, and the smell was, of course, very strong. We counted upwards of seventy nests, large structures, being heaps of sea-weed from one to two feet high, and generally lined with the fresh thick green leaves of the maritime plants growing on the islands—sea-parsley, &c. The natural colour of the Cormorant's egg seems to be a bluish-green, like the usual variety of the common domestic Duck, but over this is a thick white irregular coating of lime, which is frequently in such abundant quantity as to stand in lumps on the surface, seldom allowing much of the original colour to be visible. No doubt this superabundance of lime is produced by the bones of the fish of which this bird is said to eat prodigious quantities, and perhaps also from shell-fish." In many of the islands off the coast of northern Europe, and on the Danubian islands, vast colonies of Cormorants breed together in company with Wading-birds, Herons, &c., and the same occurs with the American species. Mr. Salvin gives a very similar description of the nesting of the Florida Shag (*Phalacrocorax floridanus*) in the cays of Honduras to that given by Mr. Seebohm above. Landbeck gives an account of the Cormorants in one of the Danubian islands, when he describes the breeding of the Herons already quoted (p. 184):—"After we had procured such specimens as we wanted of the three species of Herons and had, on passing a swamp, watched the manoeuvres of one or two Purple Herons, we determined to visit the Cormorants, which were breeding near by, in single pairs and also in large colonies, in company with Herons. The same sickening scene which we had observed at the first heronry was about to be repeated here: dung, broken egg-shells, putrid fish and birds, gave off the same noisome steuch as in the first place. The Cormorants, young and old, sitting complaisantly on their nests, bestowed wondering glances on the uninformed guests from their beautiful sea-green eyes, while the parent birds greeted us with a deep bass note, not unlike an outburst of laughter, which may in some way be compared to the sound, *Goc-goc-gog-gog-gog*, and their offspring set up a curious whistling sound, resembling *Haidioh, haidioh*, which sound we thought rather pleasant than otherwise. As soon, however, as we disturbed this peaceful scene by a shot, the Cormorants darted from their nests like snakes, with the speed of an arrow from a bow, over the trees to the other side, but did not return as soon as the Herons. After we had hidden ourselves amongst the bushes they came back, flying at a great height round and round, examining to see if the coast was clear; and at last, as soon as they seemed satisfied that all was safe, they darted on to their nests with the same celerity as they had left them, squatting close, so as to keep themselves out of sight; their caution, however, proved unavailing, and several fell to our guns. The wounded showed a courage and determination which quite surprised us: the winged birds turned at bay with great ferocity, dealing our dog such a hail of blows with their beaks as to drive him howling away. An old bird which I had mortally wounded gave me a blow through my trousers which instantly drew blood, while my brother was struck by another on the forehead, between the eyes, and narrowly escaped being blinded. The nests of these birds were larger and better built than those of the Herons, offering no small resistance to our shot."

In the Pelicans (*Pelecanus*) the principal feature is the long furrowed bill and the enormous pouch to the lower jaw, which is drawn up when the bird is at rest, but is capable of extension to an immoderate extent, and is used by the bird as a bag to hold the fish which he catches in large quantities. The number of known species of Pelican is under a dozen, and they are not found in northern climates at all. On the Nile the Common Pelican (*Pelecanus onocrotalus*) is very common, and is

seen in vast flocks, and Brehm gives an excellent account of their habits from his own observations in Egypt and the Nile Valley. He states that in no other part of Africa did he see such vast numbers of Pelicans collected together as on the Lake of Mensaleh, where the flocks of these birds covered the water to the extent of a square mile or more, looking, at a distance, like gigantic water-lilies. If any one shoots at them they rise *en masse*, with a rushing sound, not unlike the rolling of drums, which may be heard a mile off. The same observer relates that they lie on the water as if they were made



THE PELICAN

of cork, and it is only in shallow water, to the bottom of which they can reach with their long neck and hooked bill, that they usually fish for food. They hunt in company, and on large lakes or on the sea-shore they form a semicircle, gradually paddling inwards and narrowing the diameter, so as to enclose the fish, which fall victims to the rapacity of these powerful birds. On narrow rivers or canals they form two lines, which face each other and gradually meet, so as to drive the fish between them. They will, however, swallow young birds and ducklings, though fish is their general food. The daily life of a Pelican, writes Dr. Brehm, "is conducted in a very regular manner: the early hours of morning are employed in catching food, and they may then be seen hastening from all quarters to the fishing-ground, in small or large parties, the former flying in single file, the latter in the well-known

V-shape adopted by many birds of passage. Some parties may soon be seen returning from the water, satisfied with their meal, while others are making their way towards the shallow bay from which breakfast has to be procured. Towards 10 o'clock, a.m., they begin to congregate upon their favourite sand-bank, or an inland group of trees, and here they repose after their toil, some lazily digesting their food, and others more actively employed in oiling and preening their feathers, a proceeding in which they are occupied for a considerable length of time, their long, unmanageable bill being but little adapted to the work. When this is accomplished, they take a kind of siesta, some perched on trees, others on the ground, the former generally sitting bolt upright upon the branches, with their necks resting on their breasts, while the latter generally lie flat on their bellies, and doze away the noontide hours. Between three and four o'clock the whole assembly begins to wake up and prepare for another fishing excursion, in which they are engaged till sunset, after which they at once set off to their sleeping places, situated on a lonely sand-bank, or some island covered with trees, upon the branches of which they pass the night." Other naturalists have commented on the peculiarity of the Pelican perching on trees, the most unlikely resting-place for a bird of such heavy bulk. "It was a bold Pelican," observes Mr. Osbert Salvin, "that first perched upon a tree; a bird less adapted to such a resting-place could hardly be imagined. Yet there they sit on the mangrove boughs for hours, preening their feathers with their long, hooked bills, an amusement they seem to take special delight in, all the time keeping their balance with ease, even when a strong wind tries the security of their footing. Others are resting on a spit of sand that runs out from one end of the small cay, and on the stranded logs, of which plenty lie scattered about along the reefs even of the outermost atolls, being floated out of every stream during the floods of the wet season; more are still fishing in the shallows. There are few sea-birds more interesting to watch than Pelicans fishing: there is a sort of methodical determination about the way in which they set to work that seems to warrant success; and I have watched them time after time dart down, seldom failing, on coming to the surface, to bolt the fish they have secured. When a bird does miss, a look of disappointment is ludicrously shown by the dejected way in which it hangs down its bill. Four or five generally rise in company, and flying round to get the necessary impetus and height, with neck drawn in and beak slightly depressed they suddenly, as it were, stop short in the air, and dash, with outstretched neck, into the water upon the shoal of fish, which has, perhaps, shifted a little from the spot on which the last descent was made. They rest but a moment on the water—only time enough to bolt their prey, which is done by throwing the bill upwards, thus slightly distending the pouch, a ready bag to receive the fish, before held between the mandibles." Mr. Salvin is here writing of the American Pelican, the only bird of the genus which dives at all.

THE TENTH ORDER OF BIRDS.—THE SEA BIRDS (GAVIÆ).

These elegant and beautifully plumaged birds may be divided into two large families, the Gulls and the Petrels, all of them being long-winged birds (Longipennes of Cuvier), and consequently of very powerful flight. In the Gulls the hind toe is small, elevated above the level of the ground, and not united by a web to the other toes. The nostrils are placed laterally in the bill, and are rather low down in the upper mandible, as well as longitudinal. The general colour of the plumage is grey and white, the latter predominating. There are three sub-families of the Gulls, the Scissor-bills, the Terns, and the true Gulls.

THE FIRST SUB-FAMILY OF THE LARIDÆ, OR GULLS.—THE SCISSOR-BILLS, OR SKIMMERS (*Rhynchopinae*).

In these peculiar birds the bill is the characteristic feature, being long and thin, the mandibles very narrow and compressed, the lower one longer than the upper one. In other respects they much resemble Terns, the wing being very long and sharply pointed, the tail forked, and the feet small. Only three species are known, one being found in America, another in India, and a third on the Nile and the Red Sea. Dr. Jerdon gives the following account* of the Indian Scissor-bill (*Rhynchops albicollis*):—

"This remarkable bird is found throughout India, frequenting rivers, especially the larger ones.

* "Birds of India," Vol. III., p. 947.

It associates in flocks of from twenty to fifty or more, and skims up and down the river with a peculiar flight, keeping close to the water, and now and then dipping its bill into the stream. It is asserted that it picks up small fish and crustacea, and it is quite possible that it does so occasionally, but I have examined several, and never found any remains of those animals in their stomachs. I have generally discovered merely a little oily fluid, and I confess that I am ignorant of what it actually lives on. Some travellers have asserted that the African species feed on the ground, searching the soft mud with their beaks, but I have never seen the Indian birds so engaged, and doubt their doing so. At one time I was inclined to think that these birds perhaps fed at night, and had such a rapid digestion that no remains of their food were to be seen during the day, but on one occasion I shot several, in company with Mr. W. T. Blanford, on the Irrawaddy, rather early one morning, and we found nothing but the usual oily fluid, and that in very small quantity. The Skimmer breeds in April and May on sandy churrs, laying four, occasionally five, eggs of a pale stone-yellow colour with blotches of grey and brown, quite Tern-like. The young when hatched are stated by Burgess to be clad in a whity-brown down, with dark spots. Mr. Brooks writes me that he found the young Skimmers hatched by the 15th of April, at Mirzapore, and that 'it was amusing to see an army of some hundreds of these little fellows (tortoiseshell-looking things) running steadily a couple of hundred yards before us. They run well, and when we reached the end of the sand-bank they attempted to swim off, while many squatted down. They did not make much way swimming, and sank very deep in the water.'"

THE SECOND SUB-FAMILY OF THE LARIDÆ.—THE TERNS, OR SEA-SWALLOWS (*Sternina*).

These elegant birds have the plumage of miniature Gulls in a great degree, but are of a much more slender build, with very long and pointed wings and tail, and very short legs. Their flight is extremely graceful, and nothing can be more interesting than to watch a flock of Sea-Swallows engaged in hunting for their prey. Flitting along with a fairy-like flight, they may be seen dancing over the water, every now and then dipping down on the surface with a gentle splash after something which their sharp eyes have detected. They are not, as a rule, met with far from land, and sometimes large flocks may be seen beating about off the coast, and hunting in company. After severe weather they may be found on inland lakes or rivers, and several instances of the Black Tern (*Sterna fissipes*) occurring on the Thames at least sixty miles from the sea, have come under the writer's notice. Several species occur on the coast of Great Britain, and Mr. Seebohm's MS. journal of his trip to the Fern Islands off the Northumberland coast, which he has lent to the writer, contains many notes on the Sea-Swallows:—"By far the most interesting and beautiful birds inhabiting these islands are the Terns, of which there are three, and perhaps four, well-marked species breeding in the locality. The most important of these is the Sandwich Tern. On the short grass between the masses of bladder campion that grew in the wide opens almost to the spring high-water tide-mark I found three and four eggs of this bird. On one side of the wide Opens is a very much smaller island, almost bare of vegetation, and connected with the larger island by a long shingly beach, which is entirely covered at high water. It being about low water I trudged patiently and laboriously over the loose stones until I reached the small island, which I found to be a perfect little El Dorado. On a gently sloping sandbank leading up to the nucleus of the island, or the island proper, which was merely a mass of shelving rocks perhaps thirty feet across, there was a colony of Sandwich Terns' nests. These nests, if such they could be called, were slight hollows in the base sand, about the size and depression, say, of a cheese-plate. The nests and their contents were so difficult to distinguish from the sandbank that my first discovery of the colony was to find that I had 'put my foot in it,' and broken a Tern's egg. In the thick of them there must have been an average of a nest for nearly every square yard. On this little island in less than a quarter of an hour I found an Eider Duck's nest with eggs, several lesser Black-backed Gulls' nests with eggs, besides taking four Ringed Plover's eggs, seven Oyster-catcher's eggs, about a dozen eggs of the Common and Arctic Terns, and more than a hundred eggs of the Sandwich Tern, and I suppose I might have taken at least a hundred eggs of the latter bird if I had been so disposed. All the eggs of the Sandwich Tern which I brought away were in splendid condition, most of them apparently being just fresh laid. Some of the nests, or hollows in the sand, for they could scarcely be called nests, contained two eggs; a very few had three, but by far the largest number contained only

one egg. They varied considerably in colour, and some of the darker varieties approached those of the Oyster-catcher.

"On the same island, as well as on one or two of the others, was a colony of smaller Terns, which were flying about and making a great noise, as long as we were near their eggs. They make rather more of a nest than the Sandwich Tern, but it is nothing more than a slight depression in the sand or shingle, with an apology for a lining composed of dry stalks of the bladder campion. In some cases the eggs were laid on the ground without the slightest appearance of any nest, the eggs being generally two, rarely three. We were told that these colonies of smaller Terns were of three species, the Arctic, the Common, and the Roseate Tern, but the latter we were unable to make out. The majority were undoubtedly Arctic Terns, with the brilliant orange bill and light grey breast, but we could easily distinguish a considerable percentage of the Common Tern, with black-pointed bill and pure white breast. It was quite impossible to identify the eggs, as the nests were too near together, and the birds too shy. My drawer of these eggs contains eighty fine specimens, varying in colour from that of a Snipe to that of a Jackdaw. I suspect that the large wide eggs, with the small end pointed, are those of the Common Tern, and the small oval eggs are those of the Arctic Tern, but there are so many eggs intermediate in shape and size, that it is impossible to know where to draw the line. The Terns are very elegant birds upon the wing, their swallow-like shape, with their long wings and long forked tails, being extremely graceful, while their brilliant orange legs and bills are in exquisite harmony with the delicate dove-colour and white of the general plumage."

In some of the nesting-places in the Tropics, however, the Terns assemble in prodigious numbers, and on Ascension Island there are three of these "Wide-awake Fairs," as they are called. The late Commander Sperling has given an account of a visit to one of these fairs, the bird which is called on Ascension "Wide-awake" being the Sooty Tern (*Sterna fuliginosa*). "On the 8th of June, 1867," writes Sperling, "I was literally cast ashore on that island, for the periodical rollers were dashing against the coast, and my boat was upset in the surf; so giving myself a good shake, as the only available means of drying my clothes, I started for 'Wide-awake Fair,' the name which the blue-jackets who have visited the place have considered an appropriate one to designate the spot where the birds gather for nesting purposes. Leaving Comfortless Cove about the middle of the day, I walked over two dreary miles of cinders and ashes, uncheered by a symptom of vegetation, before I noticed flocks of Terns converging from various parts of the ocean to a spot apparently about a mile in front of me; but as yet I observed nothing of the 'fair.' At length, on turning slightly to the left, and surmounting a low ridge, the whole scene was disclosed. A gradual incline of a quarter of a mile terminated in a plain of ten or fifteen acres in extent, which was literally covered with the birds. The plain was surrounded by low mountains, except on the side on which we stood, and being entirely sheltered from the wind, its heat under the full blaze of a tropical sun was very oppressive. No description can give an adequate idea of the effect produced by the thousands upon thousands of these wild sea-birds floating and screaming over this arid cinder bed, the eggs and young scattered so thickly on the ground that in some instances it was impossible to avoid crushing them, and the bleached bones of dead birds were distributed in all directions. During our short walk down the incline, large flocks of parent birds hovered over our heads, and assailed us with plaintive cries, regardless of our sticks, with which we might have killed any number of them; but their beautifully pure dark and white plumage and graceful motions caused it to appear almost a sin to knock any of them down. On arriving within the precincts of the breeding-grounds their numbers increased; large flocks were arriving in endless succession from seaward; clouds of birds rose from the ground, and, joining those already attending us, their wheelings and gyrations almost made us giddy. I sat down on a lump of cinder, and the society, being at length convinced that my policy was not aggressive, went on with the ordinary routine of incubation. There were young of all sizes, from the little callow ones just hatched to the nearly fledged birds that fluttered and crawled like young pigeons. There were also lots of eggs exposed on the bare ground; but in most instances the old bird sat on its solitary treasure, hissing defiance as I approached, and fighting manfully if I attempted to remove it. The young are of a very light sooty colour both above and beneath, the ends of most of the feathers having a white spot the size of a pea, which gives them a speckled appearance. The whole of the 'fair,' both in smell and appearance, reminds one of the effect produced by a sudden entry into a large pigeon-house.

"In the interstices of the scoriæ and lava round this nursery lurk numbers of wild cats (not *Felis catus*, but the domestic breed run wild), and the bones of both old and young birds tell the tale of the ravages they commit."

Some of the most curious of the Terns are the White Noddies (*Gygis*) which inhabit the Southern Ocean, and lay but a single egg, which is placed, according to Mr. Howard Saunders, in the cavity of the branch of a tree, or in a fork of two branches, and on the points of the coral reefs, anywhere, in fact, where it will lie.

THE THIRD SUB-FAMILY OF THE LARIDÆ, OR GULLS.

THE TRUE GULLS (*Larina*).

In the Gulls, whose style of plumage is very similar in character to that of the foregoing birds, the wings are long and pointed, but not to so great an extent as in some of the Terns, and the bill is stouter and much more curved, there being a very prominent angle on the lower mandible, accompanied by a swelling on the upper mandible, which in most of the Gulls appears to divide the bill into very distinct halves, the division being generally accompanied on the lower mandible by a patch of brighter colour. The feet are also powerful, the tarsus longer, being equal to the middle toe and claw. Many of the Gulls, and particularly the Skuas (*Stercorarius*), are voracious robbers, while some of them, on the other hand, are pretty, graceful birds, of shy and timid dispositions. The Greater Black-backed Gull (*Larus marinus*) is one of the largest species known, and is peculiar to Europe and North-eastern America. It is a bird of predatory habits, doing great damage to the peaceful Eider Ducks and other wild-fowl, whom it harries relentlessly, and destroys numbers of their eggs and young. Dr. Sundström states that on the Island of Åland, off the Swedish coast, where this Gull is common, it is justly looked on as a pest, and is destroyed whenever it can be approached, which is not often, as it is very wary when it finds itself followed. It daily devours large numbers of fish, and destroys the eggs of the Eider and other Wild Ducks. He has seen it swallow small Eider Ducks, and kill and eat larger ones, and on Åland he saw one of these Gulls pursue an almost full-grown young Red-breasted Merganser (*Mergus serrator*), and force it to dive again and again, until it was tired out, when it fell a prey to its pursuer. Any dead birds that are floating on water or are on the ground are soon picked up by this Gull, and Dr. Sundström considers that it should be kept down in numbers as much as possible, as it is a very destructive bird, especially to useful birds like the Eider and other species of Water-fowl. The Lesser Black-backed Gull (*Larus fuscus*) is a miniature of the last-named species, and is distinguished by its smaller size and by its different note, as well as by its more active and lighter build. It is not quite so voracious a devourer of young birds as its larger ally, but destroys an immense number of eggs, and on the Fern Islands Mr. Edward Hargitt tells us that when the boat landed on the island where the Cormorants bred, they had to scramble up the rocks with the utmost speed to reach the nests of the latter birds before the Gulls swooped down upon the undefended eggs. On the Fern Islands, writes Mr. Seebohm, in his MS. journal, the Lesser Black-backed Gull "is by far the most numerous bird. It is scarcely correct to say that there are many colonies of them on the islands, as the whole group may be considered to be a huge colony of these birds. It is a wonderful sight on nearing an island to see it sprinkled all over with these large birds, every one standing with his back to the wind, like an innumerable army of white weather-cocks, and still more wonderful when you land, and see them flying about in every direction, around and above you, like a living snow-storm, and a noisy one too. A very small percentage of these birds are Herring Gulls (*Larus argentatus*), and the latter may be readily distinguished by the decidedly lighter colour of the back and wings. The Lesser Black-backed Gull makes a nest, which is a large slatternly structure of dry grass and weeds, with, now and then, a lot of sea-weed, just the sort of nest that the agricultural native would be likely to make if he had imported a colony of cocks and hens from the mainland in the hope of breakfasting next morning on fried eggs and bacon. Wherever there was a suitable niche amongst the rocks these nests were placed without the slightest attempt at concealment. The number of eggs laid by these Gulls and sent annually to shore for culinary purposes must be prodigious. The Herring Gulls (*L. argentatus*) nest indiscriminately amongst their more numerous relations, and, in the few cases where we were able to mark the bird, we could discover no difference in the eggs, except that those of the Herring

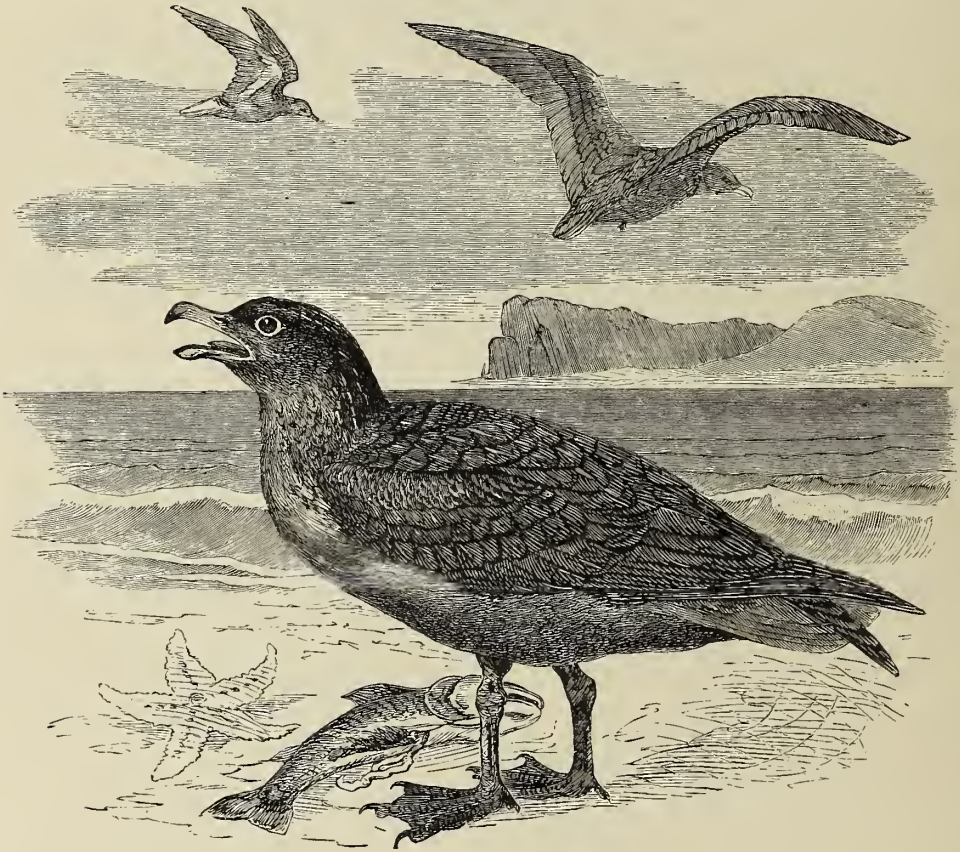
Gull appeared to be on an average slightly larger. The last-named species is found all over Europe and in North-eastern America, and from its lighter colour is often called the Silvery Gull. Macgillivray gives a good account of its habits, and writes as follows:—‘On extensive beaches, and especially on such as run out into an angle or point, multitudes may be seen reposing, often intermingled with Common Gulls (*Larus canus*), and sometimes with individuals of the two Black-backed species. The flight of this Gull is strong and buoyant, direct and unwavering when the bird is proceeding towards a distant place, and then usually elevated, but on ordinary occasions somewhat devious, although from its size this species is not capable of turning and winding so dexterously as the smaller kinds. When engaged with a shoal of fry the Herring Gulls hover over the water, now ascending to the height of about twenty feet, then skimming close over the surface; and on observing an object, stretching upward and vibrating their wings, and letting down their feet so as to touch and sometimes pat the water, they pick it up without alighting. Sometimes they plunge partly into the water, and occasionally pick up their prey while swimming. All this while they emit now and then a loud and rather shrill cry. Their food consists of fishes of small size, occasionally large dead fish, crabs, echini, asteriæ, and mollusca. In winter and spring they often travel in bands over the fields, searching the pastures, and especially ploughed lands, for worms, grubs, and insects.’”

Although, as a rule, Gulls have well-defined ranges for the separate species, the sub-family is very widely distributed, as might be anticipated in the case of such sea-loving birds, and there is no portion of the globe without its Gulls. The Skuas (*Stercorarius*) are also widely distributed, and are amongst the most rapacious and predatory of the Gulls. In Europe there are several species, the largest being the Great Skua (*S. catarrhactes*). In the Southern Ocean this species is replaced by a larger one, of a brown coloration, like its northern congener; this is the Antarctic Skua (*S. antarcticus*), and the Rev. A. E. Eaton, who went as naturalist to the late Transit of Venus Expedition, describes its habits in Kerguelen Island as follows:—“Every marsh near Royal Sound had its pair of Skuas. Many were destroyed within a radius of four miles from the ships, and before the expedition sailed from the island it was impossible to walk far without coming across dead bodies of the poor creatures. The cause of this useless slaughter was the menacing aspect of the birds, who swooped with fierce impetuosity directly towards the face of any one approaching their domain, rising only just in time to clear his head, and uttering short despairing cries. They did not feign to be crippled quite so much as the Skuas in Spitzbergen, but preferred intimidation as a means of averting danger from their nest. When they thought they had succeeded in making the enemy retreat, they celebrated their triumph standing face to face upon the ground, with their wings extended vertically so as almost to meet above their back, whilst one or two loudly chanted a pæan, consisting of a dozen notes or so delivered in the tones of a Carrion Crow. In October they also used to croak now and then during their flight, and this croak, which was discontinued in the breeding season, was very like the lower croak of a raven; indeed, it was at first difficult to re-assure oneself that they were not a species of Crow as they circled in the air far off, and the blue-jackets used to call them ‘Black Crows’ for some time, but before long the designation ‘Molly-Hawks’ came to be applied to them. This change of name took place at the commencement of the Petrel-digging. If Blue Petrels (*Prion*) were turned loose in the day-time they were invariably chased by Skuas, and killed on the wing before they had flown half a mile. Petrels of one sort or another seem to constitute the staple food of these Skuas. They hunt for them in the evening when it is becoming dusk, flying rapidly along the hill-sides, close to the ground, like Hawks, ready to pounce upon any that they may see emerging from the mouth of their burrows. Again, in the early morning they are upon the wing to waylay Petrels returning from the sea. Nor are they idle during the rest of the day; and they are very fond of birds’ eggs, of which they devour a great many. The old Skuas were much puzzled when they saw Rabbits come out of Petrel’s holes. They hovered for a long time over their heads, and at length used to stand beside the mouths of the burrows waiting for the young ones to creep forth, just as if they were watching for Petrels. It is doubtful whether they will succeed in ridding the island of these mischievous vermin, although the young birds reared by me readily fed upon rabbits procured with the sling.”

Besides the Great Skuas of the genus *Catarrhactes* there are several smaller kinds belonging to the genus *Lestrís*, of more graceful build, and distinguished by long pointed tails.

THE SECOND FAMILY OF THE GAVIÆ, OR SEA-BIRDS.—THE PETRELS (*Procellariidæ*).

Professor Sundevall makes a group of the Petrels, which he calls *Tubinæres*, on account of the tube-like apertures to the nostrils, which are peculiar to these birds. They are true denizens of the sea, being, as a rule, found far from land, and most of the specimens which find their way into our collections are obtained by catching the birds with hook and line as they follow in the wake of a ship in search of food, or by visiting the rocky islands or places where the Petrels resort for the purposes of nidification, and digging them out of their holes. With the exception of the Fulmar and a few small species, the Petrels are nearly all inhabitants of the Southern Ocean beyond the tropics,



THE SKUA.

where they may sometimes be seen in immense numbers and at a great distance from any land. They are supposed to be perfectly at home during the most violent storms, but it not unfrequently happens that they are driven on land by stress of weather, and are often picked up dead or dying not only on the sea-shore, but even some distance inland. The Stormy Petrel (*Oceanitis pelagica*) breeds in many places off the western coast of England, from the Scilly Islands up to the Hebrides, and it also nests on rocky islands off the north-western coast of Ireland. Wilson's Petrel (*O. oceanica*) is also found occasionally on our shores, but it is to the south that the naturalist must go to study the Petrels in their full profusion.

The family may be divided into three sections, the Diving Petrels (*Pelecanoides*), which have short wings and no hind toe; the True Petrels, with long wings and a hind toe always present, birds of sustained flight who swim and dive very little; and the Albatrosses (*Diomedea*), the largest of all the family. The Rev. A. E. Eaton gives a good account of the habits of the Diving Petrel (*Pelecanoides urinatrix*), which he met with in Kerguelen Island:—"This bird, as Prof. Wyville

Thomson well observes, has a close general likeness to the Little Auk, or Rotche (*Mergulus alle*), of the northern seas. Both of them have a hurried flight; both of them, while flying, dive into the sea without any interruption in the action of their wings, and also emerge from beneath the surface flying, and they both of them swim with the tail rather deep in the water. But this resemblance does not extend to other particulars of their habits. The Rotche, when breeding, usually flies and fishes in small flocks of six or a dozen birds, and builds in communities of considerable size, which are



THE STORMY PETREL.

excessively noisy. Diving Petrels, on the other hand, are more domestic in their mode of living, fishing and flying for the most part in pairs or alone, and building sporadically. They had begun to pair when we reached Kerguelen Island. The first egg was found on the 31st of October. Their burrows are about as small in diameter as the holes of Bank Martins (*Cotile riparia*) or Kingfishers (*Alcedo ispida*). They are made in dry banks and slopes where the ground is easily penetrable, and terminate in an enlarged chamber, on whose floor the egg is deposited. There is no specially-constructed nest. Some of the burrows are branched, but the branches are without terminal enlargements, and do not appear to be put to any use by the birds. Before the egg is laid, both of the parents may be found in the nest-chamber, and may often be heard moaning in the day-time;

but when the females begin to sit, their call is seldom heard, excepting at night, when the male in his flight to and from the hole, and his mate on her nest, makes a considerable noise. There seems to be a difference of a semitone between the moans of the two sexes. The call resembles the syllable *oo*, pronounced with the mouth closed, while a slurred chromatic scale is being made from *E* to *c* in the tenor. This kind of Petrel has much difficulty in taking flight from ground which is comparatively level; it is only by running against the wind, or by starting from a lump of *Azorella*, that the birds are able to rise upon the wing if they happen to alight upon a flat. During my walks on calm nights I used frequently to hear them fluttering along the ground in the dark, and (if I had a lantern) easily caught them by uncovering the light and turning it on them. They sometimes lay still in my hand without attempting to escape; but when they flew off from it, they did so in a manner which showed that they were not at all crippled. They flew to light on board H.M.S. *Supply* on dark nights in October, when there was snow upon the deck."

The True Petrels are by far the most numerous of the family. They are birds of strong flight, and have very long and pointed wings, which enable them to traverse the sea with a light and fairy-like flight, many of them flying with their legs hanging downwards, and patting the waves over which they skim. The well-known Cape Pigeons (*Daption capensis*), the Fulmar Petrels (*Fulmarus*), and the Stormy Petrels (*Oceanitis*), are amongst the most familiar birds of this group; and of Wilson's Petrel (*O. oceanica*) Mr. Eaton gives an interesting notice in the "Report on the Transit of Venus Expedition" already alluded to:—

"From the 10th of October, when we passed Cape Sandwich, until the middle or third week of November, we completely lost sight of the Storm Petrels. About the period last mentioned, however, they began to frequent Observatory Bay in large numbers. Their first appearance in it took place during a strong breeze which lasted several days. When this was succeeded by more moderate weather we saw little of them in the day-time; but towards evening they used to fly over the water like Swallows, and some of them might be observed flying near the ground far away into the country, following the course of the valleys, or playing round the inland cliffs. We tracked them along the lower hill-sides and the margin of lakes over rocks and bogs; but our efforts to learn what became of them were unattended with success. Probably at that time they were not preparing to breed, and the birds were merely going overland from the bay to other inlets of the sea. At length, when we went to Thumb Peak, their mode of nesting was discovered. Carefully watching with Lieut. Goodridge, R.N., the birds flying to and fro about the rocks, we observed that they occasionally disappeared into crevices amongst piles of loose stones, and crept under loose masses of rocks. Having meanwhile ascertained their call, we were able, by listening attentively, to detect the exact position of several of these hidden birds. They were easily caught when the stones were rolled aside; but they were in couples, merely preparing for laying, and therefore we did not find any eggs. On our way back to Observatory Bay after the Transit we called at the American station, and were informed by Dr. Kidder that he had observed this Petrel on the shore near Molloy Point. The sea-shore in the neighbourhood of Observatory Bay is of a different character (for the most part) from that which is adjacent to the American station, and being less favourable than it, was seldom resorted to for nesting by the Petrels. But the country in general about our bay afforded them unlimited accommodation. For, provided that they can find a slope of shattered rocks, with suitable chinks and crevices, or dry spaces under stones, or large boulders, sheltered from draughts, whether they be near the Sound or on the summits and sides of high hills, they readily appropriate them. The egg is laid upon the bare ground within the recess selected by the birds, either in a chance depression formed by contiguous stones, or in a shallow circular hollow excavated in the earth by the parent. Having found numbers of their nesting-places, I will describe my method of searching for them. Whenever there was a calm night I used to walk with a darkened bull's eye lantern towards some rocky hill-side, such as the Petrels would be likely to frequent. It was best to shut off the light and keep it concealed, using it only in dangerous places, where falls would be attended with injury, and progress in the dark was hardly possible, lest the birds seeing it should be silenced. On arriving at the ground selected it was probable that the Storm Petrels would be heard in various directions, some on the wing, others on their nests, sounding their call at intervals of from two to three minutes. Those on nests could be distinguished from others flying by their cries proceeding from fixed positions.

Having settled which of the birds should be searched after, a cautious advance had to be made in her direction, two or three steps at a time, when she was in full cry. As soon as she ceased an abrupt halt was imperative, and a pause of some minutes might ensue before she recommenced her cry and permitted another slight advance to be effected. In the course of this gradual approach the position of the bird might be ascertained approximately; but it had to be determined precisely, and, to learn exactly where she was, she had to be stalked in the dark noiselessly. No gleam could be permitted to escape from the lantern. Loose stones and falls over rocks; to avoid them it was sometimes necessary to dispense with slippers and feel one's way in stockings only, for should the Petrel be alarmed once with the noise or the light she would probably remain silent a considerable time. Now and then it would happen that upon the boulder beneath which she was sitting being almost attained the bird would cease calling. When this occurred, and many minutes elapsed without her cry being resumed, it was advisable to make a detour, and approach the rock from the opposite side, as her silence might be attributed to her seeing a person advancing towards her, and she would probably recommence her call as soon as he was out of sight. If she did not, a small pebble thrown amongst some rocks would usually elicit some sounds from her, as she would most likely conclude that the noise was being made by her mate returning to the nest. When the stone beneath which the bird was domiciled was gained at last, redoubled care had to be exercised. By stooping down and listening very attentively her position could be accurately ascertained. Then the lantern was suddenly turned upon her before she had time to creep out of sight, and her egg could be secured with the hand, or with a spoon tied on to a stick. Sometimes I worked without a lantern, and marked the positions of the nests with piles of stones, so that they might be revisited by day. Several eggs were obtained in February from nests which had been thus marked early in the previous month. The first egg taken by us was found by a Retriever on the 22nd of January on an island in Swain's Bay. Captain Fairfax sent me a nestling a day or two before we sailed for the Cape. Two of the eggs were laid in unusual situations. One of them was found by a man under a pringlea plant; but this may have been an egg of *Procellaria nereis*. The other was deposited just above the tide-mark in a cavity of a rock rather open to the air and light. I had found the bird there one night, had taken her up into my hand, and had gently replaced her in the hollow, nearly a month before the egg was laid."

As already mentioned, the Albatrosses are the largest of the Petrels. The wings are extremely large, the Wandering Albatross having forty secondary quills alone, and this, with the hollow bones, renders these birds capable of sustained and buoyant flight equalled by no other living bird. Their beak is very large, and about equal to the head in length. Captain F. W. Hutton, who has paid great attention to the family of Petrels during his voyages in the Antarctic Ocean, has written a very full account of the habits of these fine birds, from which the following notes are extracted:—

"The unrivalled flight of the Albatross has been the admiration of voyagers from the earliest time. Day after day with unabated interest I have watched them, and I quite agree with Mr. Gould that the Sooty Albatross (*D. fuliginosa*) carries off the palm from all competitors. Never have I seen anything to equal the ease and grace of this bird as he sweeps past, often within a few yards, every part of his body perfectly motionless except the head and eye, which turn slowly and seem to take notice of everything. I have sometimes watched narrowly one of these birds sailing and wheeling about in all directions for more than an hour, without seeing the slightest movement of the wings; this, however, is longer than usual. Wonderful as is this power of flight, it can all be explained by the simple mechanical laws which govern the direction and magnitude of pressure. Dr. Bennett states that he believes that the whole surface (of the body of the Albatross) is covered by numerous air-cells, capable of voluntary inflation or diminution by means of a beautiful muscular apparatus. . . . By this power the birds can raise or depress themselves at will. Now, I do not for a moment doubt the existence of this apparatus, for it is well known that all birds have it to a greater or less extent; but I *do* doubt its capability of doing the duty assigned to it, viz., raising the bird in the air. The temperature of the Albatross, as taken by Sir G. Grey, by placing a thermometer under the tongue, is 98° Fahr., and if we add 10° Fahr. to this in order to allow for the difference between the head and the body, we shall have the temperature of the air-cells at 108° Fahr. The temperature of the surrounding air cannot be taken lower than 48° Fahr., as the mean winter temperature of Lat. 50 S. is about 50° Fahr.

The bird, therefore, could not raise the temperature of the air taken into these cells more than 60° Fahr. This would increase its volume not quite one-eighth; and taking 100 cubic inches of air to weigh 31 grains, and the average weight of an Albatross to be 17 lbs., as given by Gould, it would be necessary, in order that the specific gravity of the bird might be brought to that of the atmosphere, that these cells should contain 1,820 cubic feet of air; or, in other words, they must be more than 1,200 times the size of the body itself of the bird, which, to say the least, would give it when flying an aldermanic appearance which I have never observed. In fact, it would require a sphere of more than fifteen feet in diameter to contain the necessary quantity of air. Even if it could thus buoy itself up, it would entirely defeat its own object; for it would at once destroy the whole of its momentum, and unless propelled forward by its wings, would drift helplessly to leeward. However, I do not wish it to be inferred that I consider the air-cells of no use. The greater portion of them are situated round the neck, wings, and fore part of the body of the bird, and I believe that by their means he is enabled to shift slightly the position of his centre of gravity and thus, with very slight muscular exertion, to vary the inclination of his body to his horizon according to the rate at which he is moving through the air.

“Dr. Bennett, in his ‘Gatherings of a Naturalist’ (p. 78), gives a diagram explanatory of the flight of the Albatross,” continues Captain Hutton; “and if I understand him rightly, says that ‘it cannot sail directly against the wind, but only in the way which sailors call “close hauled.”’ This diagram represents a square rigged ship sailing six points from the wind, a cutter sailing four and a half points, and an Albatross flying two points from the wind, from which I infer, although he does not expressly say so, that he considers that the wind helps forward the Albatross in the same way it does the ships. But that this is erroneous is apparent at a glance. A ship can sail at an acute angle with the wind because, the pressure of the wind against its sails being met by the resistance of the water, is resolved into pressures having other directions. Advantage of this being taken by trimming the sails, it ultimately results that the ship is moved in the direction of least resistance, viz., forwards. If, however, the pressure of the wind had not been met by the resistance of the water, no resolution of it in other directions could have taken place. For this reason a balloon can only drift with the wind, and the same would be the case with the Albatross. Moreover, the statement that he cannot sail against the wind is incorrect, as Dr. Bennett himself said in his first book, ‘Wanderings in New South Wales,’ the truth being that he is more often seen sailing in this direction than in any other, for the simple reason that as he moves slower against the wind than with it, he is obliged to keep going for a longer time in the former direction than in the latter, in order to retain his position near the stern of the ship. However, when sailing against the wind, the position of his wings, body, and tail, slanting a little downwards, is somewhat analogous to the sails of a ship close hauled, or, still better, to the position of a kite in the air, the momentum of the bird taking the place of the resistance of the water, or the string of the kite. This momentum is entirely owing to impulses previously given to the air by means of his wings, and when, owing to the resistance of the air, it has decreased so much that he is no longer able to move with sufficient rapidity to prevent his falling, fresh impulses have to be given. For this reason Albatrosses sail much longer in fine weather, rain especially soon destroying their momentum, and frequently obliging them to use their wings for propulsion.

“It is by combining, according to the laws of mechanics, this pressure of the air against his wings with the force of gravity, and by using his head and tail as bow and stern rudders, that the Albatross is enabled to sail in any direction he pleases so long as the momentum lasts. If, when sailing against the wind the inclination of his body is such that the upward pressure of the wind against his wings and body just balances the force of gravity, his momentum alone acts, and he sails straight in the ‘wind’s eye.’ If he wishes to ascend he inclines his body more to the horizon by means of his head and tail. If he wishes to turn to the right he bends his head and tail slightly upwards, at the same time raising his left side and wing and lowering the right in proportion to the sharpness of the curve he wishes to make, the wings being kept quite rigid the whole time. To such an extent does he do this that, in sweeping round, his wings are often pointed in a direction nearly perpendicular to the sea, and this position of the wings, more or less inclined to the horizon, is seen always, and only when the bird is turning. It will be observed that, on this principle, an Albatross sailing down wind must necessarily be descending, unless his pace is much greater than that of the air, and such I have found to be invariably the case.

"It may be objected that the resistance of the air must soon destroy his momentum ; but the fact is that it does not do so. A good illustration of this is seen in an experiment common in lecture rooms a few years ago, by which the relation of the earth was demonstrated by means of a pendulum, composed of a metal ball, suspended by a long string from the ceiling of the lecture hall. The impetus obtained by causing the metal ball to fall through the space of a few feet only was sufficient to keep the pendulum swinging with a velocity but little diminished for the greater part of an hour, notwithstanding the resistance of the sand which the point of the pendulum had to cut through



THE ALBATROSS.

twice during each vibration. The resistance of the air is well known to depend on the shape and velocity of the moving body, and to increase in proportion much more rapidly than the velocity increases. For this reason a properly shaped body and a low velocity are required to reduce it to a minimum. A certain amount of weight is also necessary to give a bird momentum sufficient to overcome resistance for a certain time, and wings are required of sufficient expanse to support it as it sails slowly through the air. These conditions are admirably carried out in the Albatross. Its expanse of wing is perhaps greater than that of any other bird, and its weight, 15 lbs. and upwards, is very large. Its shape also, when the neck is stretched out as in flying, approaches nearly to that of Newton's solid of least resistance, while more than one voyager has remarked the slowness with which it sails past. The Stormy Petrel never sails ; the Cape Pigeon only for a very short time, perhaps a minute ; the Night Hawk much longer, often between five and ten minutes ; while the Albatross, as I have before mentioned, sails sometimes for an hour."

CHAPTER X.

DIVERS—PENGUINS—TINAMOUS—STRUTHIOUS BIRDS—LIZARD-TAILED BIRDS.

THE DIVERS—Characters—THE AUKS—The Great Auk—Probably extinct—The Razor-bill—The Guillemot—Mr. Seebohm's Notes of Visits to their Breeding-places—The Experiences of a "Climmer"—The Rotche—The Puffins—The True Divers—The European Species—The Grebes—The Little Grebe, or Dabchick—The Dabchick's Powers of Diving—THE PENGUINS—Distinctive Features—A Penguin Rookery—Life in a "Johnnie" Colony—Their Nests—Their Habits—THE TINAMOUS—Their Place in the Class Aves—Their Appearance—Habits—THE STRUTHIOUS BIRDS—Their Characters—Entirely Terrestrial—Odd Use of the Wing in Running—Feathering—Distribution—THE OSTRICHES—Characters—THE OSTRICH—Mention in History—Scriptural References—Distribution—How the Bushman Hunts the Ostrich—Method adopted in Morocco—Other Modes of Hunting—An Omnivorous Bird—Its Stride—Its Cry—Habits—Its Resemblance to a Camel—The Feathers—Exportation of Feathers from Africa—A Visit to an Ostrich Farm—Use of "Incubators"—Habits of the Birds in the Enclosures—The Ostrich Dance—The Rheas, or American Ostriches—THE CASSOWARIES—Characters of the Cassowary—the Mooruk—Its Extraordinary Power of Leaping—Dr. Bennett's Account of its Habits—The Emus—Characters—Habits—Emu Beef—Threatened Extermination—Its "Booming" Note—THE KIWIS—Characters—Species—Dr. Buller's Account of its Habits—Mr. Bartlett's Note on its Attempts at Nesting—THE LIZARD-TAILED BIRDS—The *Archæopteryx Lithographica*—Description—FOSSIL FORMS—Evidence from Foot-prints—Prof. Marsh's Researches in America—Birds with Teeth—Other Forms—Concluding Remarks.

THE ELEVENTH ORDER OF BIRDS.—THE DIVERS (PYGOPODES).

THE order of the Divers comprises not only those birds, but the Auks and Grebes, forming together a very natural group, which may be divided into three families. In all of these birds the wings are short and pointed, the quills being complete in shape, and not imperfectly developed, as in the Penguins, which in many respects the Auks and Grebes resemble. The feet are placed far back in the body, so that when the birds stand they are erect and have an awkward look. The tarsus is very short, but the toes are long. The tail is always small. The Auks and Divers are birds of the northern regions only, but the Grebes are more widely distributed, and are most of them more or less migratory.

THE FIRST FAMILY OF THE PYGOPODES.—THE AUKS (*Alcidae*).

These birds have no hind toe, and are of a thick-set build, giving them somewhat of a clumsy appearance on land; but this is amply atoned for by their wonderful activity in the water. There are three sub-families of the Auks. The first contains the Razor-bills (*Alca*) and the Guillemots (*Uria*), the second the Little Auks (*Mergulus*), and the third the Puffins (*Mormon*, &c.). The Guillemots and Razor-bills have the region of the nostrils feathered and the bill rather longer. They are found in many portions of the Old and New Worlds, but always in northern localities, and where they breed both species often occur in very large colonies. The most interesting of all these birds is the Great Auk (*Alca impennis*), a species whose extinction in modern times is of the greatest regret to the true naturalist. Many people have fancied that the species will be re-discovered in the high north by some of the Arctic Expeditions, but this is extremely improbable, as the Great Auk never seems to have been a very northern bird. From the Orkneys and the Hebrides the bird reached Iceland, and then re-appeared on the coast of Newfoundland, where, during recent years, numerous semi-fossil remains have been unearthed. At one time the Great Auk appears to have been plentiful in certain of the above-named localities, but has been exterminated during the last forty years. It was the largest of all the Auks, measuring quite two feet and a half. The Razor-bill (*Alca torda*), which is its nearest representative, is only about a foot and a half in length, and is by no means uncommon in the places in which it congregates during the breeding season. Writing of the breeding colonies of the Razor-bills and Guillemots on the Flamborough cliffs, Mr. Seebohm observes:—"The Razor-bill is by no means so plentiful as the Guillemot; nevertheless, in walking along the cliffs we may count them by hundreds, if not by thousands; and he is certainly a much handsomer bird. The contrast between the brilliant black of the upper plumage and the dazzling white of the under surface, the white marks on his black bill, and the general 'get up' of his whole plumage, as if he had just come out of a bandbox, or, to use a simile more appropriate for a naturalist, as if he had only just emerged from his chrysalis, and had not ruffled a feather, makes him quite the dandy of the cliffs. Alighted on a rock, which he is by no means particular should be horizontal, he is constantly looking about in every direction, his head never being still for a moment. Poor, unfortunate fellow! the sight of a 'cobble'

putting off from the shore is a signal for him instantly to leave the cliff and get out to sea as fast as his short legs will carry him; for he knows by experience that these 'cobbles' are generally full of sportsmen' (save the mark!), thirsting for his blood. The eggs of the Razor-bill are by no means so easy to obtain as those of the Guillemot. Instead of breeding on ledges easy of access, they prefer some hole or cranny in the cliffs, where the egg has generally to be poked out with a stick, or only admired at a safe distance. From the nature of the situation it is also obvious that the eggs are scattered up and down the cliff, and are not to be got in batches, like those of the Guillemot, whose eggs may often be collected by the dozen at a time on a single ledge. The Razor-bill's eggs, too, do not vary in colour to the extent that the Guillemot's eggs do, or even as much as those of the Gulls. They may, with very few exceptions, be roughly described as white with black spots; the white has sometimes a faint tinge of bluish-green or brown, and the black is sometimes greenish, and more frequently reddish. The Razor-bill, like the Guillemot, only lays one egg, and if that one is taken away it lays a second. It also breeds regularly in the same cranny, and each individual seems to lay the same variety of egg from year to year. I have two Razor-bill's eggs, taken at intervals from the same hole, which are twice the size of the ordinary egg, and I have also one which is extraordinarily small." We are also indebted to Mr. Seebohm for an account of the breeding habits of the Guillemot (*Uria troile*) in the Fern Islands and off the Flamborough cliffs. He observes:—"The first colony which we visited at the Fern Islands was that of the Guillemot. Whilst our little craft was scudding along before the wind, the mast bending to the sail, and sometimes too far removed from the perpendicular to be altogether agreeable to our landmen's nerves, especially when our leeward bulwark dived just under water for a second or two, we could see some miles ahead a group of rocks, called 'The Pinnacles,' standing out conspicuously like great whitewashed rocks in front of one of the Fern Islands. To these rocks we now quietly rowed. They stood out some fifty feet from the cliffs, and were perhaps thirty or forty feet high, nearly perpendicular, and the summit of each a tolerably level platform, about twelve or fifteen feet square. The top and more than half-way down the sides was completely whitewashed with the excrement of the birds, and on the leeward side the smell of guano was strong, but not offensively so, as the lime almost overpowered the ammonia and entirely absorbed the sulphuretted hydrogen. The top of these 'Pinnacles' was one dense mass of Guillemots, and, as we approached, all became excitement. Streams of Guillemots poured off every corner in long strings, like Wild Ducks, but for some time the dense mass seemed to get no less. In every direction shoals of Guillemots were hurrying and skurrying away over the sea, almost as far as the eye could reach. Some desperate individuals took a header from the top of the rocks, and flinging out their legs so as to make a threefold rudder with the tail, plunged at once into the sea and dived out of danger. All this time the birds were protesting vociferously against our intrusion. By the time we had landed an anchor the rocks were nearly cleared, and for a mile or more away the sea seemed covered with them. The flight of the Guillemot is heavy and laborious, reminding one of that of a Kingfisher or a Hawk-moth. We were able to climb some distance up the 'Pinnacles,' and a good long ladder we brought with us from the next island landed us at the top. On the lime-washed top of each pinnacle were some thirty or forty eggs, looking exactly as if a smart breeze would sweep off the lot. Not the remotest vestige of a nest of any kind was there. The rock having been recently cleared of eggs, those we found were all nearly fresh laid, very clean, and looking most beautiful on the white rock; especially the dark green eggs. The Guillemot lays only one egg, and, indeed, it could not sit upon two, the egg being enormously large for the size of the bird, who does not seem to sit upon it on its breast, like a duck, for instance, but rests upright on its tail, like a dog begging. As we were leaving the rocks we saw an anxiously maternal Guillemot alight behind her egg, which, with a quiet poke of her bill, she pushed between her legs.

"The variety in the colour of the eggs of the Guillemot is something wonderful. We found the following varieties, and no doubt a greater opportunity of selection would double or treble the number, to say nothing of the additional varieties. Thirty eggs in my collection from the Fern Islands vary in the ground colouring from dark blue-green and pale blue-green to white cream colour. The character of the spots may be described as irregularly blotched, fantastically streaked, spotless, or nearly so." Mr. Seebohm has also given us the use of his MSS. containing an account of his visit to the Flamborough cliffs, where there is another noted breeding-place for the Guillemots:—

"The cliffs at Bempton are very much like those at Flamborough: a nearly perpendicular wall of chalk and flint, about three hundred feet high. This great sea wall is fast crumbling away with the action of wind and tide. It looks as if it had been built of flints, with chalk for mortar, and sometimes there seems to be as much mortar as stone, and often there is scarcely any, and, in fact, it then looks like a dry wall. The outline of the coast is very irregular; some parts of the cliff are harder than others, and stand out to sea as promontories, while others are soft, and have apparently been washed away into caves and little fiords. Here and there the cliffs have cracked, and then you can look down, and in some places climb down, through the rift to the sea. The



THE COMMON GUILLEMOT.

top of the cliffs is covered with a thick bed of soil, which slopes steep down to the edge of the rock, and is generally grown over with grass cropped short by rabbits. This steep slope to the edge of the cliff is rather dangerous, and it is very rare indeed that you can get a view of the face of the rock except from the opposite promontory. On the ledges of these precipitous cliffs the Guillemots breed in great numbers. Sometimes one may see them in such quantities as to remind one of a swarm of bees. They fly about in all directions, and numbers are constantly arriving and others leaving the ledges, while far away in the sea, down at the bottom of the cliffs, hundreds of birds are swimming about. The whole scene is full of life.

"A party of 'climbers' consists of three, two at the top and one suspended in mid-air. The latter, in consequence of the greater risk he has to run, takes one-half of the eggs as his share. This adventurous man must have a clear head, or he would become dizzy; neither must he be too heavy, or he would tire out the two men who have to lower and raise him some two hundred feet or more, twenty times a day; while, at the same time, he must have a good knowledge of the various ledges and crannies where the birds breed.

"The first puts on what he calls his 'breeches,' a belt of flat rope with a small loop at each end to which the cord by which he is suspended is attached, and two large loops through which he puts his legs. An iron bar is driven into the ground, to which a rope is attached to hang down the cliff to assist him in raising himself, and with which to make signals to the men above when he wants them to raise him or lower him down. An iron pulley running on a swivel attached to an iron spike is fastened on the edge of the precipice, so that the rope may not chafe.

"The danger of 'climbing,' *i.e.*, the danger of falling, is very slight indeed: the real danger consists in pieces of rock becoming detached and falling on the unfortunate 'climber.' L. told me



THE ARCTIC PUFFIN.

he had 'clum' for six-and-thirty years, and had met with only one really serious accident. A piece of rock, about half the size of his head, detached itself some thirty feet above him, and, though he saw it coming, he could not get out of its way. If it had fallen on his head it must inevitably have dashed his brains out, but he put up his arm to protect himself. His arm was not broken, but the muscle was absolutely torn from the bone, and it was nearly two years before he could raise it to his head again. He divides his ground into three days' work, so that he takes it all twice a week, when weather permits; in very wet or windy weather he does not 'clim.' Operations commence about the 14th of May. For the first nine days he has a good run of eggs, as the birds that breed on the ledges he visits have most of them laid; for the next nine days eggs are scarce. At the end of that time a second egg has been laid by the birds whose eggs he took during the first nine days, and he has a second run of successful collecting. He considers from two to three hundred eggs a good take. He has then a second nine days slack, and after that comes his Midsummer fling, or "shut." This is a very precarious one, and in some seasons is not

worth the getting, while in others it is nearly equal to the first two takes. L. is of opinion that no Guillemot lays more than two eggs in a season; and it is much easier to obtain accurate information respecting the habits of birds at a place like Flamborough, where the birds are scattered over some miles of cliffs, than at the Fern Islands, where they are crowded together in a dense mass on only four rocks. He also informed me that each bird frequents the same ledge year after year, and lays the same-coloured egg every year, although the variety of colour in the eggs of different birds is wonderfully great. He tells me that he used to get a very rare and highly-prized variety of the Guillemot's egg, of an almost uniform rich reddish-brown colour, on a certain ledge twice every year, for fifteen years in succession, after which the poor bird died, or was shot, or became a 'shunted dowager.' The chief thing that strikes an ornithologist who has been accustomed to estimate the eggs of the Guillemot by the Fern Island standard, and afterwards visits Flamborough, is the extraordinary beauty and variety of colouring in the eggs found at the latter station. Not only are the colours more varied, but they are decidedly more brilliant."

In the second group of the Alcineæ are found the Little Auks (*Mergulus*). The best known species is the Rotche (*Mergulus alle*), a bird scarcely larger than a Thrush, though possessing the thick-set body and dense plumage of the Auk family. It is seen in large numbers in the northern seas, where it may be observed, even in rough weather, far away from land, cresting the billows or diving for food in every direction. It nests in communities on islands such as Spitzbergen and Novaia Zemlia, and is a common bird in Greenland. The third group of the Auks contains only the Puffins, some of which are rather handsome birds of their kind, a few of them having fine crests; while in the Common Puffin (*Mormon fratercula*) the bill is variegated with bright colours, the skin of which is shed at a certain period of the year. These birds also appear to be more migratory than the other Auks.

The second family of the Diving Birds contains the true Divers (*Colymbinae*), which possess a hind toe and a very short rounded tail. The neck is long, differing much in this respect from the preceding family of the Auks, but, on the other hand, showing a great affinity to the Grebes. The Divers, however, are as much inhabitants of the ocean as the Grebes are of fresh water; and instead of being found all over the world, they are confined to northern latitudes, whence they migrate farther south in the winter season, but never quit the confines of the Palæarctic region in the eastern hemisphere, and the Nearctic region in the western. The great Northern Diver (*Colymbus glacialis*) is the largest of the three European species, but the other two are perhaps the best known—the Red-throated Diver (*C. septentrionalis*) and the Black-throated Diver (*C. arcticus*), both of which occur not only in Europe, but also in North America. Mr. Dresser gives a good account of the habits of the Red-throated Diver in his "Birds of Europe," where he writes:—"Water seems to be the element where this species and its allies are most at home; for on land it is extremely awkward, and moves along with difficulty and in the most clumsy manner; and though its flight is swift, yet it is, comparatively speaking, less frequently seen on the wing, except when on passage or on its way from one sheet of water to the other. But in the water its movements are graceful and easy, and whether swimming on the surface or diving below, it propels itself with great rapidity and ease. It swims low down in the water, and when uneasy or alarmed will submerge its body below the surface, leaving only the head and neck in view. When it dives it vanishes beneath the surface without noise or flutter, and propels itself along with its wings as well as its feet, frequently remaining for some time before it emerges to view again. When it flies up from the water it flaps for some short distance along the surface, splashing the water as it progresses, and seems as if it had a difficulty in rising into the air; but when once well under weigh it flies with great rapidity, its flight being direct, the neck stretched out horizontally. When flying any distance and when on passage, it proceeds at a great altitude, and may sometimes be heard uttering its peculiar loud cry, which, like that of its allies, is exceedingly weird and strange, resembling most the agonising shriek of distress uttered by a drowning person; and even when one is accustomed to hear this wild cry, one cannot always divest oneself of the feeling that something 'uncanny' is near, when in the dusk of the evening the wild weird shriek is suddenly uttered in the immediate vicinity. In some parts its cry is supposed to foretell the near approach of rain; but it appears chiefly to circle at a considerable altitude, uttering its cry, during rain. Though shy and very wary when it has been subjected to persecution, it is, as a rule, far less so than its allies; and when unmolested it is tolerably fearless. When in Finland I used very frequently to see the

present species in the large lakes in the interior, and I have often reclined on a rock watching several Divers which were swimming and diving quite unconcernedly within a short pistol-range of me. During the spring I collected in northern Finland many eggs of this Diver, which breeds there not unfrequently. Its nest consists merely of a little grass or a few rushes collected in a small depression in the ground close to the water, and is usually placed on a small island or on the shores of an inland lake; or else, at the Gulf of Bothnia, on the shores of the gulf itself. Whether both sexes incubate I cannot with certainty say, because I never succeeded in surprising one on its nest; for its mate, which is seldom far off, at once gives the alarm, and the sitting bird takes to the water. If deprived of their eggs, the birds will remain about their despoiled home for some time, uttering loud melancholy cries, as if bewailing their loss." The same author describes the habits of the Black-throated Diver as being very similar to those of the red-throated species; and Mr. Robert Gray, a well-known Scottish naturalist, says that the natives of Benbecula and North Uist compare the cry of the latter bird to the words "*Deoch! deoch! deoch! tha'n loch a traoghadh!*" which may be interpreted as "Drink! drink! drink! the lake is nearly dried up!" Both the above-named Divers are more beautifully marked in summer than in winter, and at this season of the year the Red-throated Diver is completely white underneath, without any appearance of the red throat from which the species takes its name.

The third family of the Diving Birds embraces the Grebes (*Podicipitinae*), which represent the before-mentioned Divers in fresh water. They are not unlike the Divers in shape, having a long neck and pointed bill, the hind toe being present and lobed, as also are all the other toes. They can scarcely be said to have a tail at all, only a little soft tuft of feathers representing this organ. The beautiful glossy plumage of the Grebes is well known as an article of dress, and ladies' muffs and jacket-trimmings are made out of the bodies of these birds, causing considerable slaughter among them for these articles of trade. Luckily, a Grebe is a bird which thoroughly understands how to take care of himself, and to capture him two things are necessary—first, to get within range of the bird, and secondly, to shoot him when once within distance, so that considerable patience is often required. The best known species in England is the Little Grebe, or Dabchick (*Podiceps minor*), which frequents most of our rivers, but more particularly affects fresh-water lakes. Here the bird is thoroughly at home, and its nest may be found by a little careful search. It is one of the most disagreeable nests to remove if required for a museum, and to all appearances most uncomfortable, if one did not remember the thoroughly aquatic habits of its owner. It is built entirely of weeds, stalks of plants, and reeds, and looks exactly like a lump of wet rubbish. Nor does a cursory examination dispel this idea, for many times we have passed by the nest, and seeing no eggs, have at first imagined that it was a disused one of last year, but on feeling under the layer of wet weed on the top of the nest the eggs have been discovered, very carefully and artfully concealed. This concealment is said to be the work of the birds themselves on seeing the approach of an intruder; it has, however, been asserted that the female having laid the eggs, covers them up with wet rubbish, and leaves the action of the sun to assist in hatching them. It seems to us difficult, in the case of the Little Grebe at least, to prove the truth of these statements. We have studied the nidification of this species under peculiarly favourable circumstances, and have found more than one nest every season for the last seven or eight years, and, notwithstanding our utmost caution in approaching the nest in the hopes of seeing the bird leave it, we never yet succeeded in surprising the female, but on arriving at the nest we found the eggs always perfectly hidden from sight by a mass of wet weed, which did not always show signs of having been hastily piled on, but in some instances at least appeared to have been flattened down on the top of the eggs. So quick to perceive danger, however, is the Dabchick, that the mere launching of a boat half a mile off is cause for alarm, and the pair of birds would have plenty of time to conceal their eggs before any one could get up unperceived. The eggs, when first laid, are white, but as incubation proceeds they get more and more discoloured, until at last they become of a dirty yellowish-buff colour. In summer the Dabchicks are much handsomer birds than in winter, for, like all Grebes, they put on a summer plumage, when the neck becomes red and the under-parts black, instead of silvery white. At this time of year they are somewhat more easily obtained, as they trust as much to concealment as to their power of diving; and if there is a little weed growing above the surface of the lake they often betake themselves to it for shelter, and as their bodies scarcely appear above

the water, their necks alone are left to attract attention, and these may often be detected even among the weed-stalks. In winter they assemble in little companies, probably consisting of the old birds and their families of the previous summer, and on the approach of danger they dive under water and disperse in different directions; there is, however, generally some place of refuge for which they make, perhaps a spot where the bushes overhang the water or a bed of rushes near the bank. They may, perchance, be intercepted on their way thither, but so sharp are the Dabchick's eyes, and so great the



THE CRESTED GREBE.

distance which he can swim under water, that out of twenty birds which may be seen swimming together at first, probably not more than half-a-dozen come again under the observer's eye. The little birds will, perhaps, appear on the surface as light as a cork floating, but only for an instant: the slightest movement in the boat and they disappear like lightning, so that frequently the only intimation one has of their presence is the splash and the ripple which indicate where the bird has gone down. Where it will reappear is quite a matter of conjecture, for, once under the water, it may press forward in any direction, and come up again fifty yards off in quite an unexpected quarter. We remember once finding a Dabchick feeding in a narrow ditch ending in a *cul-de-sac*, and posting ourselves at the end of the ditch, we waited patiently for the bird to appear, making sure that we should



THE GIANT PENGUIN.

shoot it without fail; but the Grebe, nothing daunted, dived under water, came straight down the ditch, passed us at a point where it was not more than six yards broad and about two yards deep, and reappeared in the river about twenty yards off, diving the instant we moved, and coming up again far out of shot. This is only one instance out of many we could relate which have occurred to ourselves in our chase after Dabchicks, when the birds have saved themselves by their adroitness in swimming and diving. Besides the Little Grebe, we have resident in this country the Great Crested Grebe (*Podiceps cristatus*), and in winter the Red-necked Grebe, the Eared Grebe, and the Slavonian Grebe sometimes visit us. Most of the Grebes are migratory, and some are very widely distributed, occurring over nearly the whole surface of the globe. One of the most remarkable is the South American species (*Centropelma micropteryum*), from Lake Titicaca, in the Bolivian Andes, a bird of large size, but with such small wings that it cannot fly.

THE TWELFTH ORDER OF BIRDS.—THE PENGUINS (IMPENNES).

The Penguins represent in the Southern Ocean the Auks and Divers of the Northern Seas. They are called *Impennes* on account of their wings, which are very small in comparison with the size of their bodies, and quite hard in texture, very rigid, and movable only at the base, and covered with small stiff feathers of a bristly nature. The body is long and flat, of an oblong form, and the bird swims with a wavy motion, using its feet and wings as auxiliary portions of the body. The Penguins are found on some of the rocky islands in immense numbers, and Dr. Bennett gives a good idea of a Penguin rookery in Macquarie Island, where they occupied about thirty or forty acres of ground:—"The number of Penguins," he writes, "collected together in this spot is immense, but it would be impossible to guess at it with any near approach to truth, as during the whole day and night 30,000 or 40,000 of them are continually landing, and an equal number going to sea. They are arranged when on shore in as compact a manner and in as regular ranks as a regiment of soldiers, and are classed with the greatest order, the young birds being in one situation, the moulting birds in another, the sitting hens in a third, the clean birds in a fourth, &c.; and so strictly do birds in a similar condition congregate, that should a bird that is moulting intrude itself upon those that are clean, it is immediately ejected from among them." During the late expedition to Kerguelen Island numbers of Penguins were found nesting on the island, and the Rev. A. E. Eaton writes as follows concerning the species known as *Pygoscelis teniata* :—

"The Johnnie (as the whalers call this bird) is common in Royal Sound. It builds in communities, some of only a dozen, others from 70 to 150 families. A more populous colony upon the mainland was visited by six officers from the ships, who estimated the number of nests in it to amount to 2,000 or more. These larger communities are approached from the sea by regular paths, conspicuous at a distance, like the well-worn sheep tracks, which lead straight up the hill from the water. Their formation is due to the Penguins being very particular about where they land and enter the sea. A small party of the birds occupied a position upon the neck of a low promontory, within an hour's walk of Observatory Bay. Their nests were nearest to the farther side of the isthmus, but when they were approached the male birds used to run to the water, not by the shortest route, where it was deep close to the rocks, but by the longest, to a place where the shore was shelving. It was amusing to see them start off in a troop as fast as their legs could carry them, holding out their wings, and tumbling headlong over stones in their way, because as they ran they would keep looking back instead of before them, and to hear their outcries. Panic and consternation seemed to possess them all, but the females (possibly because they could not keep up with their mates) seldom went far from their nests; and if the intruder stood still, soon returned and settled down again upon their eggs. Not many weeks had passed before a change was effected in their conduct. The young were hatched, and now the mothers anxiously endeavoured to persuade them to follow the example of their fathers, and run away to sea. But the nestlings preferred to stay in their nests; they did not mind if the stranger did stroke them, although their anxious mothers did run at him with open mouths whenever he dared to do so. Only a few of the older chicks could be prevailed upon to stir, and they, after waddling a few yards, became satisfied with their performance and turned to go home again. The mothers who had straggled to a greater distance began to return too. It was now that the more

tardy youngsters began to experience the ills of life. Every Penguin that had reached its place before them aimed blows at them as they passed by towards their own abodes. One of the little birds certainly did seem to deserve correction. It saw its neighbour's nest empty and sat down in it. The old female Johnnie, the rightful occupier, presently returned, in company with her own chick, to whom, having put her head well into his mouth, she began to administer refreshment after his run. Seeing them so pleasantly engaged, the small vagrant thoughtlessly, presuming on her generosity, went nearer and presented himself to be fed also, as if he had a right to her attention and care. She looked at him while he stood gaping before her with drooping wings, unable for a moment to credit what she saw. But suddenly the truth flashed upon her, and, provoked by his consummate audacity, she gave vent to her indignation, pecked his tongue as hard as she could, chased him out of the nest, darting blows at his back, and croaked ominously after him as he fled precipitately beyond the range of her beak, leaving trophies of down upon the scene of his unfortunate adventure. The whole of this community of Penguins was subsequently boiled down into 'hare soup' for the officers of *H.M.S. Volage*, and very nice they found it.

"The nests were composed of dried leaf stalks and seed stems of *Pringlea*, together with such other suitable material as happened to be at hand. There were two eggs in every nest, and one of them was invariably larger than the other. Most likely the birds hatched from the larger eggs are of the opposite sex to those which are produced from the smaller. Whether the big or the little egg is the first to be laid was not ascertained.

"As is the case with many other kinds of birds, Johnnies are very regular in their habits. Every afternoon at nearly the same time they repair to the shore when they have done fishing, landing in small parties at their accustomed places at the heads of shallow inlets. On issuing from the water they dispose themselves to rest, seldom proceeding beyond the verge of the shore. Those which are inclined to sleep put their heads behind their flippers; the others stand amongst them with the neck shortened so as to bring the head down close to the body, with the beak slanting upwards and forwards, somewhat in the manner of a very young Thrush during repose. Their eyes present a rather tearful appearance, and resemble bits of dull black glass set in their heads—perhaps the nictitating membrane may be kept drawn over them. At frequent intervals a kind of watery fluid is ejected from their mouths by a shake of the head. I was led to suspect that these Penguins are liable to be attacked by Seals, for in places not much frequented by man, if they once effect a landing they do not readily return to the water on being alarmed, but run away from the sea uphill as fast as they can go. After they have gone some distance, they turn round and look back while they take breath; but as soon as they are rested sufficiently they willingly resume the ascent. It is not until they have been driven so far as to become thoroughly tired that they refuse to proceed farther, but when this stage has been reached it is useless to urge them to advance without a pause. As they face about, the sight of the boat ready to push them over is greeted with deprecating sighs, and should this be disregarded, and they be sent over upon their backs, as soon as they regain their feet they rush at their driver, launch their bill at his knees, beat their wings furiously against his calves and shins, and make a dash on all-fours down the hill at full speed to regain the sea. When they became accustomed to being chased by men, the Penguins acquired the habit of betaking themselves to the water at the first alarm. A small party of these birds used persistently to land in Observatory Bay every evening at the very time when the men erecting our huts were returning to the ship after their work. Such of the Johnnies as managed to escape being caught one day were sure to reappear the following evening just at the critical time, dragging themselves out of the water to afford sport to the men. By the time that the huts were completed, the survivors were reduced in number to a couple of birds, and there can be little doubt that these would have followed their late companions into the soup-kettle had the putting up of the Observatory occupied one more day. The cry of the Johnnie distantly resembles the short bark of the fox."

THE THIRTEENTH ORDER OF BIRDS.—THE TINAMOUS (CRYPTURI).

It seems at first sight strange that the Tinamous, so much resembling game-birds in their appearance, should be placed almost at the end of the series of birds, and so far from what would be considered their natural allies; but in reality they form an extremely interesting group, inter-

mediate in some respects between the Carinate birds and the Struthious birds (*Ratitæ*). They may briefly be described as game-like birds, having the bones of the skull like the Struthiones, but having a keeled sternum, which places them in the Carinate series.

The Tinamous are strictly neotropical in their habitat, and do not occur away from the South American region. The body is thick and the head small, the bill is slender, a little shorter than the head itself, gently curved and depressed, the tail small and often concealed by the coverts, the wings short and rounded. About forty species of Tinamous are known to science at present, and these are divided into nine genera. Many of the birds are found only in forests, while others, on the contrary, frequent open grass-lands, and have the habits of the European Quails. The eggs are very striking in their coloration, being sometimes of a very deep purplish shade, whilst in some instances they are bluish-green; the texture is always smooth and very glossy, and when once seen a Tinamou's egg can hardly be mistaken. On the ground these birds run with great rapidity, and seldom endeavour to save themselves by flight, while their intelligence appears to be of a low order, and when suddenly alarmed they seem to become stupefied with fear. On such occasions, as we are informed by Mr. Darwin, a man on horseback, riding round and round them so as to narrow the circle each time, may knock over as many as he pleases, but the usual way to capture them is by means of a small lasso or running noose, made of an ostrich feather fastened to the end of a stick; and a boy thus armed and riding on a horse has been known to secure as many as forty in a day. The Tinamous are much appreciated as articles of food, and they have on this account been much harried, so that species which were once common in some countries have now to be sought for at long distances from their former haunts. This has been the case with the Tataupa (*Crypturus tataupa*), in the neighbourhood of Buenos Ayres, and the late Mr. Durnford stated that it is not to be met with now within a hundred miles of that city. This species, according to the late Prince Maximilian, of Neuwied, prefers open quarters to forest land, and runs with great speed over the ground. Towards evening it utters a very peculiar cry, consisting of two long-sustained notes, followed by six or eight of the same tone, but short and quickly repeated. The species of *Nothura* are more Quail-like in their habits, and have been designated by some authors the American Quails. Of the *N. maculosa*, near Buenos Ayres, Mr. Durnford writes, that it is resident and abundant wherever the rough paja-grass or thistles afford any cover. It also frequents fields of maize or other cereals in considerable numbers. On a Sunday or holiday it is a curious sight to watch the "sportsmen" of various nationalities flocking to the different railway stations to have a day's "perdiz" shooting. The dogs impressed into their service are, like their masters, of various breeds—from a Bull-terrier to a Pointer—it being considered of primary importance to be accompanied by some specimen of the canine race. When collecting in the Chuput Valley in Patagonia, the same naturalist fell in with the Elegant Tinamou (*Calodromas elegans*), which he found common in the valley and on the hills in very dry spots. It nests under the shelter of a small bush, and after scraping a slight hollow in the ground, lines it with a few fragments of grass and feathers, laying sometimes as many as ten eggs. The remarkable character of these, of a uniform pea-green colour, with a highly polished appearance, is well known. About dusk these birds come from the shelter of the long grass or bushes, where they have lain during the day to feed; and at that time they can be heard calling to each other in every direction. Their note is a loud and oft repeated whistle, uttered in a low key.

DIVISION II.—THE STRUTHIOUS BIRDS (*RATITÆ*).

The characters which distinguish the *Ratitæ* from the Carinate birds, or *Carinatae*, were briefly alluded to at the commencement of the present article,* and consist chiefly in the absence of a keel to the sternum, which is therefore raft-like. The Struthious birds are amongst the largest of the class, and are entirely terrestrial in their habits, not one of them being able to fly, though they make up for this deficiency by an extremely swift power of running, and in some of the species the tiny wings are elevated so as to form a kind of sail, which helps the bird along, when fleeing from danger. A good idea of the speed at which these birds can go is given in Mr. Smelt's description of the chase of a Rhea, or South American Ostrich (*Rhea americana*), on the pampas,

* Vol. III., p. 239.

in the district of Tapalqueen, on the south-western frontier of Buenos Ayres, where the species is tolerably numerous, and is hunted by Europeans with dogs, and by the Indians with the well-known "bolas," or balls:—"We soon found," he says, "that the report we had heard as to the abundance of Ostriches here had not been exaggerated, and that in whatever direction we went we were sure of finding them. After riding for about a mile and a half, we viewed five birds feeding in a hollow, at a distance of about seven or eight hundred yards from us, and discovered that by skirting some high grass to our left we should most probably be able to get close to them without alarming them; so we at once started in that direction, taking two of the dogs with us. Before we had gone a couple of hundred yards we came suddenly on an old male bird, a splendid fellow, and we slipped the dogs within five-and-twenty yards of him. Then began one of the most exciting runs it was ever my good fortune to witness. Away we went, through the thick 'pajas,' or tufts of high reedy grass, the hounds keeping well up, and apparently rather gaining ground than otherwise. In this way we ran for two miles or more, when the Ostrich, emerging from the high grass, steered away across some bare hills, where he got the full force of a very fresh breeze that was blowing at the time, of which he at once took advantage, running down and across it in an oblique direction, with his left wing raised, which he made use of as a sail. The pace hitherto had been good—in fact, I may say, without fear of exaggeration, more than good—but now that he had got the wind, it was simply racing, and, in spite of all our efforts, and those of the dogs, he seemed to leave us literally as though we were standing still. We kept pounding away, however, in pursuit, as well as we could, for some time, when a man who was driving cattle turned him to the right, and he headed straight back towards us for a few seconds before he found out his mistake; we were thus enabled to get on good terms with him again. After running for about fifteen minutes more, he began to show unmistakable symptoms of distress, and one of the dogs, a large brindled one, ranged fairly alongside, and was about to make a spring, when he doubled as short as if he had been fixed on a movable pivot, and catching the slant of the wind, and setting his wing again, he was off like a flash of lightning, and leading by nearly a quarter of a mile, the hounds having shot lengths ahead before they could turn. It was evident, however, that he was tiring fast, and, although the pace was still good, we got alongside again, but with no better result than another double, and another good lead for the bird; and these tactics he continued to repeat each time we neared him, always gaining an immense advantage thereby. It became plain, however, that he could not last much longer, and eventually the dogs pinned him, when we rode up and gave him his *coup de grâce*, cutting off his wings as trophies." The accounts of hunting the Ostrich in Africa which are given by travellers are very similar in character to the above account of the Rhea hunt, and the extract has been made principally to illustrate the use of the wings as a help to the bird when it runs. The feathering of the Struthious birds is most peculiar, and when viewed from a little distance the birds look as if they were covered with hair instead of feathers. This appearance is enhanced by the loose character of the plumage, the feathers being very long and lax, while they have none of the little barbules* which hook the cross barbs together, and tend to make the feather of an ordinary bird firm and compact in itself.

The distribution of the Struthious birds, to judge from the fossil remains which have been found, was at one time much more extended than it is at the present day. They seem, however, to have always been developed to a greater degree in the southern portions of the globe, and never to have penetrated very far north. This is amply demonstrated by the presence of a large number of forms of Moa (*Dinornis*) in New Zealand, and the gigantic *Aepyornis* of Madagascar, which were as much larger than the Ostriches of the present day as the latter birds are than the majority of birds now living.

The *Ratite* may be divided into two families, the Ostriches (*Struthionide*), amongst which the Cassowaries are classed, and the Apteryges (*Apterygide*). These families have well-marked characters for their distinction.

THE FIRST FAMILY OF THE STRUTHIOUS BIRDS.—THE OSTRICHES (*Struthionide*).

In all these birds the bill is short, though powerful and robust; it is rather flattened, and has a large "nail" at the tip. The nostrils are longitudinal, and are situated at the base of the bill. The

* See Vol. III., p. 238.

eyes are large, and are protected by well-developed and stiff eyelashes. The legs are extremely stout, and no hind toe is ever represented. The Ostriches may be further divided into two sub-families.

THE FIRST SUB-FAMILY OF THE STRUTHIONIDÆ.—THE OSTRICHES (*Struthionidæ*).

The principal character which distinguishes the Ostriches from the Cassowaries is the absence of a second feather or highly-enlarged after-shaft,* which in the latter birds is as long as the feather itself, and forms a second plume. The wings, too, are feathered, the plumes being large and tolerably long, while the tail feathers are small and not greatly developed. The two genera belonging to this sub-family are *Struthio* and *Rhea*, the former containing the African Ostrich (*Struthio camelus*), the latter the Rheas of South America, of which there are three species.

THE OSTRICH (*Struthio camelus*).

Interesting as the natural history of the Ostrich has been from time immemorial, regarded as one of the birds mentioned by the most ancient writers, it is doubtful whether the latest phase of the history of the Ostrich, viz., its domestication in "Ostrich Farms," will not prove of greater importance to mankind than its existence in a state of nature. To Mr. Julius de Mosenthal's book on "Ostrich Farming," and the monograph on the "Struthious Birds" by Mr. J. E. Harting, the author is indebted for the following statements condensed from these works:—The Ostrich, although it seems in ancient times to have extended to India and Central Asia, is not known to inhabit those countries in the present day, but within the Christian era eggs of this bird, and even some living examples, were brought to China from Turkestan and Central Asia, and the King of Samarkand is mentioned as having paid a tribute of Ostriches' eggs to China in the year A.D. 605. Remains of the species have been found in the Sewalik Hills, in North Western India, along with those of the Camel and the Giraffe, but it is doubtful whether the Ostrich ever extended into India within historic times, as no mention is made of it in Sanskrit literature, while the bird is not alluded to during the celebrated march of Alexander the Great through Asia; at the same time, Mr. Surtees, who resided for some years in Sindh, is stated by his friend, Canon Tristram, to have heard of many traditions pointing to a former existence of the Ostrich in that country. In Syria, Arabia, and Mesopotamia, it seems to have been known from time immemorial, and Sir Henry Layard informs us that Ostrich feathers appear as ornaments on the robes of the figures in the oldest sculptures of Nimrod, together with the emblematic flower, and frequently figures on the Babylonian and Assyrian cylinders, from which we may conclude that the Ostrich was a sacred bird. It is frequently mentioned in Scripture, where, however, according to Canon Tristram, the Hebrew word is often rendered as "Owl." Some of the references to the habits of the bird are true to nature, and others are based on popular beliefs which hold even to this day among Orientals. "It is the hoarse complaining cry by night," writes Canon Tristram, "to which Job compares his own sorrowing lamentations under the visitation of God. The same simile occurs in Micah i. 8: 'I will wail and howl, I will go stripped and naked: I will make a wailing like the dragons, and mourning as the ostriches' [owls, marg.]. In the reply of the Lord to Job, the habits of the Ostrich are thus set forth: 'Gavest thou the goodly wings unto the Peacocks? or wings and feathers unto the Ostrich, which leaveth her eggs in the earth, and warmeth them in dust, and forgetteth that the foot may crush them, or that the wild beast may break them? She is hardened against her young ones, as though they were not hers: her labour is in vain without fear; because God hath deprived her of wisdom, neither hath he imparted to her understanding. What time she lifteth up herself on high, she scorneth the horse and his rider.'—Job xxxix 13--18. Here we find mention made of the beauty of its plumes, of its habit of leaving its eggs on the surface, of hatching them in the heat of the sand, of its desertion of its young, of its reputed stupidity, and of its extraordinary fleetness."

Xenophon, in his "Anabasis," mentions the occurrence of Ostriches in the plains of Artemisia, on the left bank of the Euphrates, in the neighbourhood of Thapsacus, but according to Olivier, who travelled there towards the close of the last century, they are no longer found there; but they are killed every year not far from Damascus, and they are still hunted in many parts of Arabia, though

* See Vol. III., p. 238.

everywhere in Western Asia the Ostrich seems to be a rapidly-decreasing bird. Canon Tristram states that even at the present day the bird occasionally wanders from Arabia towards the Belka, to the south-east of Palestine, and he himself obtained a specimen there, shot by Sheik Agylle Agha.

In Egypt and Nubia the Ostrich is now seldom found, and it scarcely ever occurs north of 17° N. lat. In 1816 Burckhardt saw many wild Ostriches in the plains of El Mograh, between Cairo and Suez; but Von Henglin searched for them in vain in Central Egypt and the Lybian Desert, though he was informed by Prince Halim Pasha, a "trustworthy hunter," that he had found freshly-disturbed Ostrich nests and breeding-places within a few days' journey from Cairo. The species is found from Southern Algeria throughout Africa to the interior of the Cape Colony, wherever an open country suits its nature, and where increasing cultivation and persistent hunting have not driven it away.* They are not found, for instance, on the West Coast of Africa, which is girt by a belt of forest land, nor do they occur in many parts of the East Coast, like Zanzibar and Mozambique, such skins and eggs as are sold in these places being brought from the interior. Some ornithologists consider that there are two species of Ostrich in Africa, and the late Mr. Andersson affirmed from his own experience that two, if not actually three, kinds of Ostrich were to be met with in South Africa alone. In one species he states that the male is black, while the female is grey, and in the second species the male is like the same sex of the ordinary kind, but is rather larger, while the female is jet-black like the cock bird. The existence of the third species depended very much on native testimony, but Mr. Andersson was inclined to believe in it.

The mode of hunting the Ostrich is different in various parts of Africa. In ancient times Strabo speaks of a tribe in Lybia, which he calls *Struthophages*, or Ostrich-eaters, who used to cover themselves with an Ostrich-skin, and thrusting the right arm into the skin of the neck, which they held aloft, by this device easily approached their game and killed it. Similar to this in some respects is the well-known method of the bushman, who clothes himself in the skin of one of the birds, and imitates their motions so exactly that it is almost impossible to detect the difference at a little distance off. The sham bird approaches from the leeward side of the flock, for if once a bird winds him off it goes, and all the trouble is taken for nothing. "Now it turns its head as if keeping a sharp look-out; now it picks at the verdure on the ground, or at any water-melon or shrub which may be in its path; now it shakes its feathers, sometimes trotting and sometimes walking, until at length the wary bushman gets within bow-shot of some unlucky bird, and when, having discharged his arrow, one of the flock runs off in any direction, the sham bird runs off too. The rest of the flock are quite unable to understand why their comrade should suddenly run away and then lie down, and they allow their enemy to follow them up until they share the same fate. Several are often secured in this way before they get scent of the impostor." In Morocco the only way to approach the Ostrich is on horseback, as no artifices can be employed, the birds being so wary and the plains so vast on which they are found. The horses are stated by Canon Tristram to undergo a long and painful training—abstinence from water as much as possible, and a diet of dry dates being considered the best means of strengthening their wind. The hunters of the tribes to the east of the M'zab set forth with small skins of water strapped under their horses' bellies, and a scanty allowance of food for four or five days judiciously distributed about their saddles. As soon as the birds are descried, two or three of the hunters follow the herd at a gentle gallop, endeavouring only to keep the birds in sight, without alarming them or driving them at full speed, when they would soon be lost to view. The rest of the pursuers leisurely proceed in a direction at right angles to the course the Ostriches have taken, knowing by experience their habit of running in a circle. Posted on the best look-out they can find, they await for hours the anticipated route of the game, calculating upon intersecting their path. If fortunate enough to detect them, the relay sets upon the now fatigued flock, and frequently succeeds in running down one or more, though some of their horses usually fall exhausted in the pursuit. The bird, when overtaken, offers no resistance beyond kicking out sideways.† Ostriches are also captured by the bushmen by means of pit-falls or with the lasso, and the Somali tribes hunt in the same way. The birds are often shot at the pools to which they resort for drink, and they seem to be fond of standing in the water in the heat of the day, Von Henglin having stated that Ostriches often resort to the

* Dr. Hartlaub, in the "Vögel Ost Afrika's," by himself and Dr. Finsch, gives a very good monograph of the Ostrich.

† Harting, "Ostriches," &c., p. 46.

shores of the Red Sea for this purpose. A well-directed charge of swan-shot aimed at the necks of the stooping birds will often lay several low at once. Another plan of capturing the Ostrich by the bushman may be noted. On finding the nest, he removes the eggs and seats himself in it, when he is able to shoot the bird on her return with his poisoned arrow before she can recover her surprise at the intrusion. In Sennaar Ostriches are occasionally brought down by a kind of boomerang. In Arabia the birds are killed on the nest, the hen sitting very close and covering over the eggs, with neck outstretched, and its eye fixed motionless on the approaching enemy. When killed, it is laid upon the eggs, and the hunter, having buried the blood of his first victim, lies in wait till sunset for the return of the male, when the latter is also slaughtered.

The Ostrich appears to be a very omnivorous bird, and one which died in the Zoological Gardens in all probability owed its fate to 9½d. worth of copper money which it had swallowed. In a wild state it also swallows quantities of stones, sand, bones, and even pieces of metal, which are picked up indiscriminately; its natural food is also very varied, consisting of seeds, berries, fruit, grass, leaves, beetles, locusts, small birds and animals, snakes and lizards. Dr. Livingstone estimates the rate at which the Ostrich travels at about twenty-six miles an hour, reckoning each stride at twelve feet, but Canon Tristram measured the bound when the bird is at full speed as from twenty-two to twenty-eight feet. The cry is likened by Canon Tristram to the hoarse lowing of an ox in pain, and by other observers to the roar of a lion; in the Scriptures it is alluded to as a "wailing."

The Ostrich is gregarious, and appears to be more so in South Africa than in North Africa, where it is seen in little companies of from four to six individuals, the scarcity of food having, perhaps, something to do with the different habits in the latter locality. It is also a polygamous bird, each cock bird associating with three or four hens, all of which lay their eggs in one large nest scooped out in the sand, and relieve each other by turns at incubation, the male taking his turn at sitting as well as his wives. In the breeding season the males fight vigorously for the possession of the females. Though each hen bird lays a large number of eggs in the nest many more are dropped in the neighbourhood, and Mr. Layard states that these are supposed to be broken by the parents as soon as the young are hatched, and serve for their first meals. The little ones come into the world under a certain amount of risk, for the cock bird often becomes impatient towards the end of the period of incubation, which lasts about six weeks, and has been observed to lean with his chest upon an egg, crack it, then take it up in his beak by the membrane inside the egg, and shake it violently until the young bird dropped out, when he would swallow the membrane, and repeat the operation on another.

The Ostrich was called the "Camel-bird" by the ancients, and its peculiar legs and head, with the great eyelashes shading its large eyes, were doubtless the cause of its being considered by Aristotle and Pliny to be partly bird and partly quadruped; and it resembles the Camel, not only in frequenting the same localities, but in many other points. The hard pad-like covering to the breast-bone of the Ostrich is analogous to the large callous pad on the Camel's chest, both the bird and the animal reposing on their chests when they lie down. The diaphragm is also largely developed in the Ostrich. Nor does the resemblance to the Camel end here, for even in life there is evidence from modern European travellers of a likeness sufficient to account for the ancient name. Mr. Palgrave met with Ostriches in North-west Arabia, and writes:—"When we saw them far ahead, running in a long line one after the other, we almost took them for a string of scared Camels." Again, the Rev. A. C. Smith, in his "Attractions of the Nile," observes as follows:—"When seen at a distance moving over the desert, the camels struck me as resembling in a most remarkable degree their desert companion the Ostrich. It may seem strange to say that a bird and a quadruped have the same profile, yet such is undoubtedly the fact with these two denizens of the same sandy wilds; both hold their heads very forward, with necks much elevated and stretched out; then the long legs of the Camel are all near together, whereas those of the Ostrich are wide apart, and the result is that, seen at a distance, these two very different creatures might be easily mistaken for each other."

In the same work on Ostriches and Ostrich-farming, from which so much of the above information has been derived, is a full account of the last-named pursuit, fast growing into a very valuable branch of industry. The value of the plumes is in these days principally appreciated by ladies, but in old times it was the male sex that mostly used them as adornments. Not to mention the Prince of Wales's feathers of our own country, a badge adopted by the Plantagenets, the feathers of the Ostrich are

mentioned in far more remote ages, appearing on the Egyptian hieroglyphical monuments, where they are spoken of as *shoo*, and they were used by the Egyptians as emblems of justice, from the webs being equally balanced and of equal width on each side of the shaft. "Warriors," says Mr. Harting, "wore Ostrich plumes in their helmets from a very early date. In the comedy of 'Acharnenses,' which was



THE OSTRICH.

represented in the Theatre of Bacchus at Athens (B.C., 425), Aristophanes depicted a general called Lamachoo, who carried two beautiful white Ostrich feathers in his helmet; while both the Greek Theophrastes (Hist. Plant. iv., 5) and the Roman Pliny clearly indicate that Ostrich feathers were thus used in their day." The noble Roman ladies are said to have kept domesticated birds for the purpose of riding, and still earlier the Egyptian Queen Arsinoe, who lived some time before the celebrated Cleopatra, had her statue erected on Helicon, in which she was represented as riding on an

Ostrich, and the bird is said to be capable of bearing a full-grown man. The writer has himself seen a light kind of carriage drawn by an Ostrich, in the Jardin des Plantes, at Paris. Although this purpose is not likely to come into vogue in the present day, the demand for food may bring Ostrich flesh into use, as it is said to be good eating, while the eggs are of the bulk of twenty-four common hens' eggs, and an omelette is pronounced by travellers to be very palatable.

When, in 1876, Mr. de Mosenthal wrote his report, Ostrich feathers, to the value of more than £600,000, were exported from Africa, and they were classified under thirty different headings according to their colour, size, and weight. The largest exportation comes by way of Egypt, which contributes nearly half of the above amount; the Cape follows very closely, Barbary comes next with one-sixth of the whole sum, Mogador with a value of £20,000, and lastly Senegal, with a value of £3,000 only. The finest feathers are those received from Aleppo; they come from the Syrian desert, and are the most perfect in plumage, breadth, grace, and colour, but are very rare. The feathers from the Cape are as white as the Aleppo ones, but are much inferior in quality, and are surpassed by those of Barbary, Senegal, Egypt, and Mogador, whilst the most inferior are the plumes from Yamani, in Arabia, which are described as very thin and poor. The Cape seems to afford the best artificial breeding grounds, but in Algeria Ostrich-farming is being attended with success; while, so far, the attempts made in Australia have not turned out very productive. Improved kinds of incubators are now introduced, and have proved very successful in rearing the birds, and, in fact, it is only by this means that Ostrich farming can ever be rendered a successful venture. With the accompanying extract from Mr. de Mosenthal's book, detailing an account given by Mr. Hillier of a farm kept by Mr. Douglas, at Hilton, near Graham's Town, South Africa, the article on this most interesting species must conclude:—"After breakfast we began, on foot at first, to make our round of the various Ostrich troops and flocks, scattered or located as they are over a farm of some 3,000 morgen (6,000 acres); and as we shall require the aid of the artificial memory afforded by the recollection of the way we went, we will tell our story in that order, beginning where we began, with the first flock of the year's chickens we came to. The first chickens of this year were hatched in the early part of the month of August, and these, with others hatched during the following month or six weeks, now run together, and form a flock of forty-four fine healthy growing birds. Some of them are very large for their age, and all are remarkably lively and in good condition. It was very amusing to see how they gathered round the coloured boy who looked after them. They ran away to him if startled in any way, and came eagerly at his call.

"It was evident that their instincts had accepted him in the place of their original parents. These birds are now housed every night, and though this will no doubt be prudent for some time to come, on account of storms, yet some of the oldest look quite able to take care of themselves. In fact, were they with the parent birds, they could not be gathered, many of them, under their wings, or otherwise much defended from the cold. This group of young birds are kept in the home field, and, we believe, occasionally get a little lucerne. The condition and health of this flock of birds are most satisfactory. It proves most triumphantly that Ostriches hatched by machine, when the operation is properly conducted, are equally healthy with those that come into the world by the old-established and ordinary process; and that the same set of conditions must have been complied with, and the various necessary manipulations which instinct teaches the old birds to perform must have been successfully imitated, in artificial incubation. We think Mr. Douglas told us he had lost but one since they were hatched, and this by accident. The next troop of this year's birds is a flock of sixteen. They looked to us about a month old, but we were not told their age. These, too, looked exceedingly healthy. A boy was in attendance, and will continue so a little longer, till they are strong enough to join their little brothers and sisters. This little family is carefully housed every night in a warm covered stable. We forgot to say that the older flock are put in a kind of kraal within the shed, into which they can run when it rains. By this plan they get gradually accustomed to sleep out at night. The next flock we saw was the baby flock of fourteen, some of which were only a day or two old, while some were a week or ten days. These were exceedingly pretty little things, like giant young partridges, but with the special peculiarity of having little bristles all over them mixed with their down. They were very lively, and gathered round their guardian, and were some of them fed with a little cut lucerne. We were told that for the day or two after their birth they do not eat, but seem

to be looking about curiously upon the great world they have so strangely come into. Then, after two days, they begin to attend to the duties of life by setting up a mill. This is precisely the fact. The little things, taught by instinct, eat no food till their gizzards are prepared, for which purpose they go about picking up little hard stones, of no doubt the exact kind required. After this preparatory process is completed they eat a little soft green food. This infant flock is gathered into a warm room at night; some of the youngest are put into the 'mother' crib of the incubator, whilst others are accommodated with a lodging between blankets, or otherwise comfortably provided for. We find, by adding together the above flocks, that we have some seventy-four chickens, all hatched since August by the incubator—all alive and well.

"We next mounted our horses, and proceeded to an enclosure separated by the river from the home ground. In this enclosure we found fifteen full-grown birds, or mostly full-grown, among which were an old cock and two laying hens, and possibly a pullet, which Mr. Douglas told us he thought was just beginning to lay. The old cock was very savage and fightable, and was given some mealies (maize) to amuse him while we rode quietly by. The old fellow attacked his master while on horseback some little time ago. He succeeded in getting his breast up to the horse, and kicked most furiously; but, owing to the unusual position he had attained, his kicks went for nothing, except once, when his toe ripped open the skin of the horse's flank, which set the horse going in turn. The fact is, that if the old birds only knew how to use their beaks as well as their feet, they would be most dangerous animals. As it is, though they peck off your hat, and pull your ears, their operations in this way do not amount to much. These fifteen birds have a large enclosure all to themselves. And here we may as well say that there are no sheep on the farm, and in the enclosures dedicated to the Ostriches, except in the home field, no other kind of stock. We next, after a mile, more or less, came to an enclosure in which were a very fine old cock and two laying hens. Here we were shown a nest, after due precaution having been taken to decoy the old monarch into a pen with some mealies, and safely shut him up; but we must confess that we gave one or two rather anxious looks towards the pen aforesaid, thinking it just possible that he might get out of it and come and look after us. The two hens were both sitting down, which we were informed they do; also, that when one goes to lay, the other goes to keep her company, though we did not inquire whether that was the etiquette of Ostrich life, or the special habits of these two birds. We were informed that the hens lay their eggs somewhere round about the nest—that is, within a few yards, and that the cock bird trundles them along, and places them in due order in the nest. In fact, the male Ostrich seems the very antipodes of roosters and drakes, for he takes the chief solicitude about the future of the eggs, placing them in the nest, and always sitting on them by night, with warding and divers other little attentions and performances necessary to a successful issue of incubation, which our good friend Mr. Douglas has carefully observed, after much patient watching, and has duly made a note of. Here we saw a fine nest of eggs, and proceeded to count them, but were stopped with the information that they would never hatch. No! never. And why? Simply because they were artificial; and so good is the imitation, that they deceived not only novices like ourselves, but even the Ostriches, who ought to have known better.

"Out of the enclosure, given up to the exclusive use of this polygamous family of three, we entered through a locked gate into a large enclosure, or paddock, in which were fifty-eight one and two-year old birds. They all looked exceedingly well, and though they did not dance, they seemed full of life. They do sometimes favour the spectators with a dance, and it is one of the funniest of all the freaks or habits of animals that evidence a sense of the jokeful we ever beheld. We once saw some twenty nearly full-grown birds waltzing together. They began with a sort of sidling slow revolution on their toes, moving their wings gently up and down, and presently they seemed to get into the spirit of the thing without the aid of any fiddler that we saw, and spun round at a rate that would have astonished any one but a dancing dervish. In dancing, they swept round and round without ever coming into contact with each other. Our fifty-eight young friends soon seemed anxious to make our acquaintance, or, perhaps, to see if there were any mealies, and they came up all round us, some two or three at a time, poking their little and long necks right into one's face. Quite docile and quiet, yet they seemed very inquisitive, and we should fully have expected, had we indulged in such vanities, to have seen our diamond breast-pin

disappear as a specially valuable stone to furnish grinding power for the bird. It is a queer feeling to be in the middle and under the inspection of some fifty-eight pairs of eyes or more, with a good sharp bill between each pair that could easily appreciate—or say, borrow—any little thing they take a fancy to. It was queer, but it was most satisfactory, for here were birds two years old, machine-hatched, and in size, health, and quality everything that could be desired. This completed our round of observation, in which we saw a good many contrivances for feeding, plucking, and general management, the result of much thought and patient investigation. Since the farm has had no sheep upon it the veldt has very much improved, and no doubt is still progressing in the same satisfactory direction.”

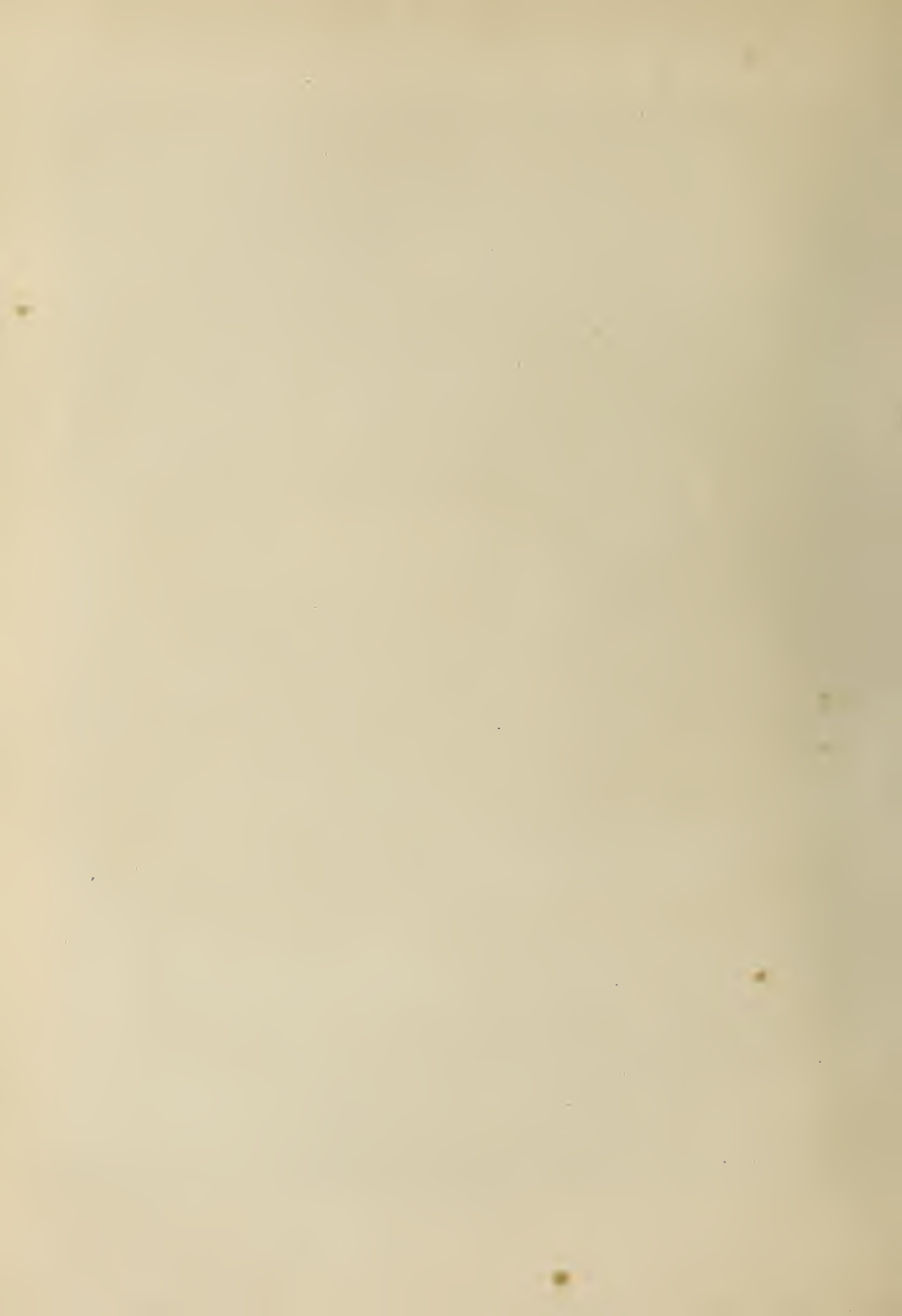
The Rheas, which are the remaining representatives of the sub-family *Struthioninae*, are distinguished by having three toes, while the head and the neck are fully feathered, and there is no tail visible. They are confined to the Central and Southern portion of the Neotropical region, and the three species of the genus *Rhea* are the Common Rhea (*R. americana*), which ranges from Bolivia, Paraguay, and South Brazil down to the Straits of Magellan, Darwin's Rhea (*R. darwini*), which replaces the foregoing bird in Eastern Patagonia, and the Long-billed Rhea (*R. macrorhyncha*), the exact habitat of which is as yet unknown. The habits of these South American Ostriches are not unlike those of their African relative, but as the feathers are not of such beauty as in the latter species, a lesser exportation of plumes takes place from South America. They appear, however, to be as capable of domestication, and an excellent account of their breeding in England is given by Mr. Harting.

THE SECOND SUB-FAMILY OF THE STRUTHIONIDÆ.—THE CASSOWARIES (*Casuarinae*).

The Cassowaries and the Emus, which compose the present sub-family, are distinguished by the wings and the feathering of the body. The former are bare, and are represented only by some stiff horny shafts of large size, and the after-shaft, or second feather on the body-plumes, is very long, and almost equal to the feather itself, so that it has the appearance of being a double feather.

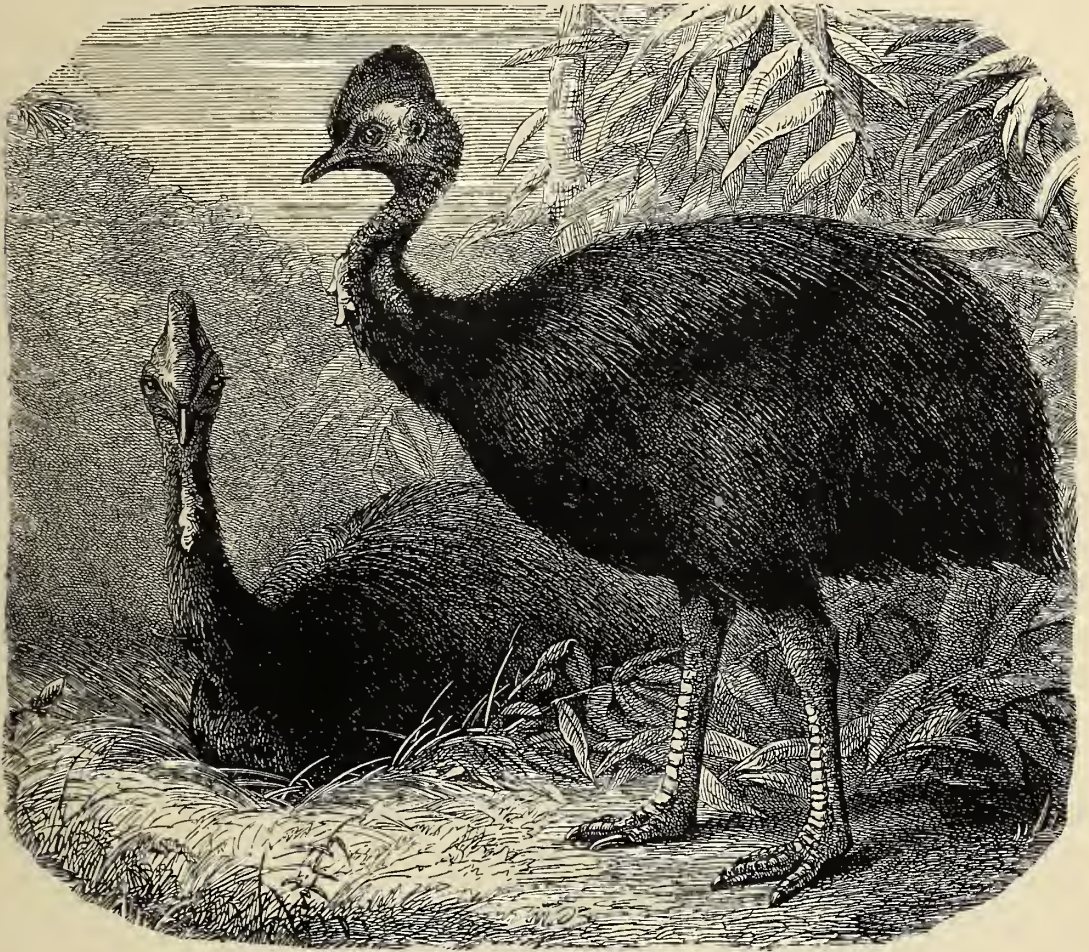
The Cassowaries have three toes, with the claw of the inner one elongated and sharp, while on the head there is a horny casque: otherwise the head is bare. Nine species of Cassowary are now known to science, and they are all peculiar to the Papuan sub-region, that is, to New Guinea and the adjacent islands, Northern Australia having one species also. These birds inhabit the thick forests, and are very shy in their native haunts, as well as being of a fierce disposition, using both beak and legs dangerously in striking. They always kick in front, elongating the body at the same time, while the Emu kicks outward and backward. Their habits are not very well known, the most familiar species being the Mooruk, of New Britain (*C. bennetti*), which is captured by the natives and reared in captivity by hand; and the inhabitants of the Aru Islands also keep Cassowaries in confinement. It is probably owing to this means, and to the uselessness of the birds as articles of trade, that they are preserved to the present day, as the limited range of each species would conduce to its speedy extermination if hunted to death. Like the Ostrich and the other flightless birds of this order, the Cassowaries are very timid and shy, and of the Mooruk Dr. Bennett writes:—“They are exceedingly swift of foot, and possessed of great strength in their legs. On the least alarm they elevate the head, and on seeing danger, thread localities where no human being can follow them, and disappear with incredible rapidity. The Mooruk, with its powerful legs and muscular thighs, has an extraordinary power of leaping, and it was from this circumstance that the first specimen brought from New Britain was lost. One day, when allowed its liberty, it made a spring on the deck and went overboard. As it was blowing a strong breeze at the time the bird perished. Their wings aid them in running, but are never used for defence. The Mooruk is a robust bird, and differs from the Ostrich in its internal anatomy, its digestive organs being adapted only for a soft and nutritious diet—fruits, vegetables, insects, and eggs, grain or any similar hard substance not being digestible unless it had been previously boiled. It also requires a quantity of small gravel or pebbles to aid in the trituration of its food, and often picks up snails and small bits of iron for a similar purpose. I never heard them utter a sound like *Mooruk*. I am inclined to consider that the name signifies in the native language ‘swift,’ resembling closely the Malay term ‘a muck,’ or mad career; and the extraordinary rapid movements of these birds rather confirm my idea on this subject. The chirping sounds of the Mooruk are very





peculiar, being modulated according to the urgency of their wants and desires. Sometimes these notes are varied, as if speaking; at one time they are mild, at another very vehement; then rising to a higher and more rapid chirp, as if scolding; afterwards becoming plaintive, as if beseeching for something; again loud and rapid, as if impatient at delay. At a little distance this modulation of the chirping notes seems as if the birds were holding a conversation, and has a very singular effect."

Both the male and female Cassowary sit on the eggs, which are of a beautiful green colour, the texture being rough and covered with small round tubercles. The period of incubation in the Mooruk,



THE CASSOWARY.

according to observations at the Zoological Gardens, is about fifty-two days. For the Ceram species (*C. galeatus*), Mr. Wallace gives the period as "about a month." In addition to the shape of the helmet or casque, the Cassowaries are classified according to the number of the pendent wattles on the neck, which are two in number in four of the species, one only in the fifth, *Casuarium uniappendiculatus*, of Salawati, and in the remaining four they are absent altogether. These wattles and the adjoining skin of the neck are generally of a bright colour—blue and green and red.

The Emus (*Dromæus*) are the only remaining examples of the *Casuarinæ*, but they may be distinguished by their feathered head and neck, the absence of a casque or helmet, and by the stout curved nails to the toes. Only two species are known, the Common Emu (*D. novæ hollandiæ*), and the Spotted Emu (*D. irroratus*), the former being widely distributed in the Australian Continent, while the latter is found only in Western Australia. There are several points

in which the Emus differ from the Ostriches in habit: for instance, they pair, and the male remains attached to a single female instead of being polygamous, and the female Emu is also the larger bird of the two. Writing of the Common Emu, Mr. Gould says:—"Its flesh has been compared to coarse beef, which it resembles, according to Mr. Cunningham, both in appearance and taste, and is good and sweet eating; nothing indeed can be more delicate than the flesh of the young ones. There is little fit for culinary use upon any part of the Emu, except the hind



THE EMU.

quarters, which are of such dimensions, that the shouldering of two hind legs homeward for a mile distance once proved to me as tiresome a task as I ever recollect to have encountered in the colony. I may remark that its flesh proved of the greatest service to Dr. Leichhardt and his intrepid companions during their overland route from Moreton Bay to Port Essington, in the course of which, but more particularly between the head of the Gulf of Carpentaria and Port Essington, the sight and capture of the Emu was almost a daily occurrence; so abundant, in fact, was it, that he states that he saw in the short space of eight miles at least a hundred, in flocks of three, five, ten, and even more at a time. On the continent of Australia the Emu was formerly abundant about Botany Bay and Port Jackson Harbour; but is now only to be seen

in the plains of the interior, over whose solitudes it roams in great numbers, and where it breeds, depending on the strength and swiftness of its legs to avoid the pursuit of the stockmen and their dogs. Farther and farther back, however, will it be driven, until it be extirpated, unless some law be instituted to check its wanton destruction.

"The note of the Emu is a low booming or pumping noise, which we know is produced by the female by means of the expansion and contraction of a large membranous bag surrounding an oblong opening through the rings of the trachea. The eggs, which are placed in a cavity scooped in the earth, generally in a sandy soil, are six or seven in number, of a beautiful dark-green, resembling slagreen in appearance, five inches and three-quarters in length by three inches and three-quarters in breadth. They are held in much esteem by the natives, who feed upon them whenever they can be procured."

The Spotted Emu (*D. irroratus*) has often bred in captivity in this country, and a very interesting account of the acclimatisation of this species in Surrey has been written by Mr. William Bennett, of Betchworth.

THE SECOND FAMILY OF THE STRUTHIONES.—THE KIWIS (*Apteryx*).

In these curious birds, whose native home is New Zealand, one meets with many characteristics of the Ostriches, while at the same time there are many points in which they differ from them. They are not so large as the smallest Cassowary, the biggest species of the genus, the Large Grey Kiwi (*Apteryx haastii*), being only about two feet in height; the neck and feet are also proportionately shorter than in the Ostriches and Cassowaries. The bill is very long and smooth, the nostrils being placed at the very tip, a peculiar provision in these birds, which, as will be seen presently, plunge the whole of the bill into the ground in search of their food. The plumage of the body much more resembles hair than feathers, both to the sight and touch, and the wings are so completely hidden, that the bird appears to have absolutely none at all.* There is no after-shaft to the feathers of the body, and the toes are four in number, the hind toe being elevated above the level of the others, very short and thick, and having the nail a little smaller than on the other toes.

Four species of *Apteryx* are known to Science, two of them being of a reddish-brown colour, and two of a grey plumage. The North Island in New Zealand possesses two of the species, and the South Island two, as follows:—The North Island Kiwi (*Apteryx mantelli*) is represented in the South Island by the *Apteryx australis*, while Owen's Apteryx (*A. oweni*), or the Little Grey Kiwi of the South Island, is replaced in the North Island by the Large Grey Kiwi, or Haast's Apteryx (*A. haastii*). It is doubtful, however, whether the larger birds ought to be considered anything more than bigger races of the smaller species. Dr. Buller has given a good account, as far as it goes, of the habits of *Apteryx mantelli*, but the great difficulty in observing these birds in a state of nature renders our knowledge of their economy rather meagre. The above-named gentleman writes:—"The Kiwi is in some measure compensated for the absence of wings by its swiftness of foot. When running it makes wide strides, and carries the body in an oblique position, with the neck stretched to its full extent and inclined forwards. In the twilight it moves about cautiously and as noiselessly as a rat, to which, indeed, at this time, it bears some outward resemblance. In a quiescent posture the body generally assumes a perfectly rotund appearance; and it sometimes, but only rarely, supports itself by resting the point of its bill on the ground. It often yawns when disturbed in the daytime, gaping its mandibles in a very grotesque manner. When provoked, it erects the body, and raising the foot to the breast, strikes downwards with considerable force and rapidity, thus using its sharp and powerful claws as weapons of defence. The story of its striking the ground with its feet to bring the earth-worms to the surface, which appears to have gained currency among naturalists, is as fanciful as the statement of a well-known author that it is capable of inflicting a dangerous blow, sometimes even killing a dog.

"While hunting for its food the bird makes a continual sniffing sound through the nostrils, which are placed at the extremity of the upper mandible. Whether it is guided as much by touch as by smell

* Hence its name, *Apteryx*, from the Greek *a*, not, and *πτερυξ*, a wing.

I cannot safely say ; but it appears to me that both senses are called into action. That the sense of touch is highly developed seems quite certain, because the bird, although it may not be actually sniffing, will always just touch an object with the point of its bill, whether in the act of feeding or of surveying the ground ; and when shut up in a cage or confined in a room, it may be heard all through the night tapping softly at the walls. The sniffing sound to which I have referred is heard only when the Kiwi is in the act of feeding or hunting for food ; but I have sometimes observed the bird touching the ground close to, or immediately round, a worm which it had dropped, without being able to find it. I have remarked, moreover, that the Kiwi will pick up a worm or piece of meat as readily from the bottom of a vessel with water as from the ground, never seizing it, however, till it has just touched it with its bill in the manner described. It is probable that in addition to a highly-developed olfactory power, there is a delicate nervous sensitiveness in the terminal enlargement of the upper mandible. It is interesting to watch the bird, in a state of freedom, foraging for worms, which constitute its principal food : it moves about with a slow action of the body, and the long flexible bill is driven into the soft ground, generally home to the very root, and is either immediately withdrawn with a worm held at the extreme tip of the mandibles, or it is gently moved to and fro by an action of the head and neck, the body of the bird being perfectly steady. It is amusing to observe the extreme care and deliberation with which the bird draws the worm from its hiding-place, coaxing it out, as it were, by degrees, instead of pulling roughly or breaking it. On getting the worm fairly out of the ground it throws up its head with a jerk and swallows it whole. The stomach of a recently-killed wild bird which I dissected contained a hinau-berry (*Eleocarpus dentatus*), and rounded fragments of white quartz. Dr. Day writes me :—"In its very muscular stomach I have usually found the remains of beetles, pebbles, and many kernels of the hinau-berry."

The Apteryx has been known to lay in confinement, but up to the present time no young birds have been hatched in a state of captivity. Mr. Bartlett contributed to the Zoological Society an account of the *Apteryx mantelli*, and its attempts at nesting in the Zoological Gardens. "During last year" (1867), writes Mr. Bartlett, "these birds showed symptoms of a desire to pair. This was known by the loud calling of the male, which was answered by the female in a much lower and slower note. They were particularly noisy during the night, but altogether silent in the daytime. On the 2nd of January the first egg was laid, and for a day or more the female remained on the egg, but as soon as she quitted the nest the male bird took to it, and remained constantly sitting. On the 2nd of February the second egg was laid, the female leaving the nest as soon as the egg was deposited. The two birds now occupied the two opposite corners of the room in which they were kept, the male on the two eggs in the nest under the straw, the female concealed in her corner, also under a bundle of straw placed against the wall. During the time of incubation they ceased to call at night, in fact, were perfectly silent and kept apart.

"I found the eggs in a hollow formed on the ground in the earth and straw, and placed lengthwise, side by side. The male bird lay across them, his narrow body appearing not sufficiently broad to cover them in any other way. The ends of the eggs could be seen projecting from the side of the bird. The male continued to sit in the most persevering manner until the 25th of April, at which time he was much exhausted, and left the nest. On examining the eggs, I found no trace of young birds. Notwithstanding the failure of reproducing the Apteryx, I think sufficient has been witnessed to show that this bird's mode of reproduction does not differ essentially from those of the allied Struthious birds, in all cases of which that have come under my notice, the male bird only sits. I have witnessed the breeding of the Mooruk, the Cassowary, the Emu, and the Rhea, and the mode of proceeding of the Apteryx fully justifies me in believing the habits of this bird to be in no way materially different from those of its allies."

THE THIRD DIVISION OF BIRDS.—THE LIZARD-TAILED BIRDS (SAURURÆ).

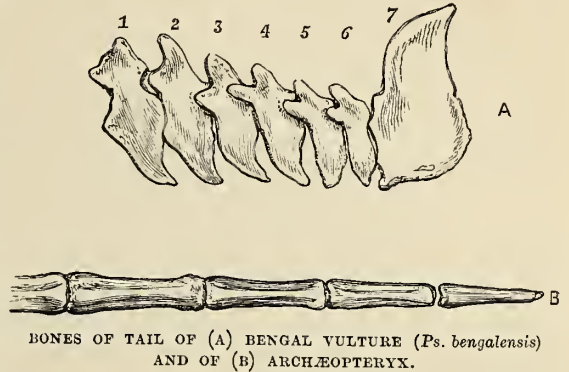
Only one representative of this division is known, and that a fossil one, the *Archæopteryx lithographica*. The first evidence of the existence of a bird in strata of Oolitic age was furnished by the discovery of the impression of a single feather in a slab of lithographic stone from Solenhofen in Bavaria, described and figured by Herman von Meyer in 1861, and named by him *Archæopteryx*. Later on in that year, the greater portion of the skeleton of an animal was discovered in the same





formation at Solenhofen, with impressions of feathers radiating fan-wise from each anterior limb, and diverging obliquely in a single series of a long tail. The characters of this singular feathered fossil seemed so unlike those of a bird, that Professors Andreas Wagner and Herman von Meyer concluded that the animal in question was most probably a feathered reptile and not a bird at all.

Happily for British palæontologists, this remarkable fossil was secured for our National Museum in 1862, and a memoir on it was contributed by Professor Owen to the *Transactions of the Zoological Society* in the same year. The specimen is preserved in intaglio and relievo, on two slabs of Solenhofen limestone, the lower one of which represents the ancient surface of what was once tidal mud, upon which the carcase of the bird was left after its death, the upper being composed of the layers of alluvium deposited by subsequent tides, and to these we are indebted for the preservation of the fossil. The impressions of the feather are most beautifully preserved upon the lower slab, exhibiting the tail and wings, and some further portions of the skeleton itself. The head, neck, and dorsal vertebræ alone are wanting. The right scapula and humerus, and both the fore-arms, are well preserved. Two of the fingers of the wing appear to have been free, and to have been armed with sharp recurved claws. In modern birds the anterior of the three digits of the



ARCHÆOPTERYX LITHOGRAPHICA.

pinion remains free, and in some species supports a claw or spur—as, for instance, in many of the Thrushes a tubercle, or small callosity, can be felt with more or less distinctness. Several Plovers and Jacanas have spurs, as also the Spur-winged Geese (*Plectropterus*), while the Screamer (*Palmadeda cornuta*) has two spurs, and the Megapodes have a tubercular rudiment of a pinion-claw.

The lower right limb is well preserved, consisting of femur, tibia, and tarso-metatarsal bones. To the latter bone four toes are articulated, one hind toe and three fore toes, the latter armed with sharp recurved claws. The foot agrees with that of a true perching bird, but from the fan-wise and rounded arrangement of the wing-feathers, it would appear to have been a bird of feeble flight. The most singular characteristic of this Oolitic bird is its tail, which is complete, and consists of no fewer than twenty narrow elongated vertebræ, the dimensions of which slowly but constantly diminish, so that the last is the smallest. The feathers of the tail are attached in pairs to each vertebra throughout its entire length. In most recent birds we find the tail very short and powerful, composed of vertebræ varying from five to nine in number, with well-developed spinous processes on their upper and under side, the last vertebra being very peculiarly formed, and, with few exceptions, it is always the *largest*. This last joint, called the *os coccygis*, or ploughshare bone, is composed of two or more coalesced vertebræ, and gives attachment to the rectrices or quill-feathers of the tail, besides supporting the oil-glands. The above woodcut exhibits the peculiar ending to the tail of *Archæopteryx*, as compared with that of a recent bird.

Before finally concluding the present article, it remains to say a few words on the FOSSIL FORMS,* which are very few in number. With regard to Palæontology, the numerous papers published by Professors Owen and Huxley in this country, Professor Alphonse Milne-Edwards in France, and the masterly researches carried on by Professor O. C. Marsh, of Yale College in America, have thrown a flood of light upon the ancient forms of the class Aves, before almost wholly unknown, and have to a great extent removed those barriers which seemed before to separate birds completely as a class from the rest of the Vertebrata.

That the presumed existence of birds at the period of the Secondary rocks should have been first intimated by their footprints may seem strange, but as far back as 1835, a notice appeared in "Silliman's Journal," stating that Dr. Deane had discovered impressions *resembling the feet of birds* upon some slabs of red sandstone from Connecticut. Dr. Hitchcock was the first who submitted these tracks to careful scientific investigation, and concluded that they had been produced "by the feet of birds." These gigantic three-toed footprints have been found in more than twenty places, scattered through a tract of country nearly eighty miles in extent, and they are repeated through strata more than one thousand feet in thickness.† Upwards of two thousand of these Ornithichnites had been observed and examined by Professor Hitchcock twenty years ago; but notwithstanding the most diligent and careful search, not a vestige of organic remains of either bird or pterodactyle have as yet been discovered in these beds. Numerous coprolites occur in the Connecticut rocks, and Dr. Dana has very ingeniously argued, from the analysis of their bodies, that, like guano, they are the droppings of birds rather than of reptiles.

The fossil footprints exhibit regularly, where the joints are seen, the same number as exists in the feet of living three-toed birds, and in each continuous line of tracks the three-jointed and five-jointed toes are placed alternately outwards, first on one side and then on the other. In some impressions, besides the three toes in front, the rudiment of the fourth toe is seen behind. It is not often that the matrix has been fine enough to retain impressions of the integument, or skin of the foot, but in one specimen found by Dr. Deane at Turner's Falls, on the Connecticut River, these markings are well preserved, and have been recognised by Professor Owen as resembling the skin of the Ostrich and not that of reptiles.

Later researches, however, tend to prove that these footprints are not, after all, those of birds; for Professor Marsh, in his address to the American Association for the Advancement of Science, in 1877, remarks:—"A careful investigation of nearly all the specimens yet discovered, has convinced me that there is not a particle of evidence that any of these fossil impressions were made by birds. Most of these three-toed tracks were certainly not made by birds but by quadrupeds, which usually walked upon their hind feet alone, and only occasionally put to the ground their smaller anterior extremities. I have myself detected the impressions of these anterior limbs in connection with the posterior footprints of nearly all of the supposed 'bird-tracks' described, and have little doubt that they will eventually be found with all. These double impressions are precisely the kind which Dinosaurian reptiles would make, and as the only characteristic bones yet found in the same rocks belong to animals of this group, it is but fair to attribute all these footprints to Dinosaurs, even where impressions of fore-feet have been detected, until some evidence appears that they were made by birds. I have no doubt that birds existed at this time, although at present the proof is wanting."

Of the *Archæopteryx* from the Oolitic beds we have already spoken, and passing on from the Oolitic to the Cretaceous formation, we still find remains of birds exceedingly rare. But, just as in the preceding series of beds, land-surfaces and fresh-water deposits are few in number, and terrestrial organic remains are consequently uncommon. In 1840, under the name of *Cimoliornis diomedeus*, Professor Owen described a leg and a wing-bone of a longipennate natatorial bird, equalling the Albatross in size; but the subsequent discovery by Dr. Bowerbank of several additional bones and a part of the head, led that careful observer to conclude that these remains belonged to a pterodactyle, and not to a bird, as first supposed by Owen. As long ago as 1858, true bird-remains had been discovered by Mr. Lucas Barrett in the Upper Greensand, near Cambridge, a formation

* For assistance in this portion of the article the author is indebted to his friend, Dr. Henry Woodward, F.R.S.

† Lyell's "Manual of Geology," 5th Edition, p. 348.

extensively worked for phosphate of lime extracted from coprolite nodules. Portions of the metacarpus, metatarsus, tibia, and femur have been detected and named by Professor Seeley *Enaliornis* (*Pelagornis*) *barretti*. Professor Newton believes them to be the remains of a true bird, having some resemblance to a Penguin. These are the only bird-bones of Cretaceous age met with in this country.

Thanks, however, to the labours of Professor O. C. Marsh, of Yale College, Newhaven, Conn., U.S.A., in the remarkable series of Cretaceous lacustrine deposits of the Atlantic coast and the region of the Rocky Mountains, no fewer than thirteen species of bird-remains have been described by that accomplished palæontologist. The most important of these remains are no doubt the *Odontornithes*, or birds with teeth, the first of which, the *Ichthyornis dispar*, was described in 1872. This remarkable bird was, though apparently aquatic in his habits, provided with well-developed wings, constructed upon the usual typical plan of a bird. The jaws were furnished with compressed pointed teeth, fixed in distinct sockets. The vertebræ were bi-concave—a character unknown in the entire class Aves, but common to certain reptiles, amphibia, and fishes.

The other remarkable bird with teeth is the *Hesperornis regalis*, a gigantic diving bird, wonderfully like an existing Diver, or Grebe, but standing between five and six feet high, also from the cretaceous formations of Kansas. The teeth of this great bird were not implanted in sockets, but in a deep groove extending the whole length of the mandible. The teeth have pointed crowns, covered with enamel, and supported on stout fangs, like the teeth of Mosasauroid reptiles. Externally, the jaw-bones appear to have been covered by a horny bill, as in modern birds, and the extremity of the jaw was without teeth, and covered by a bill. The breast-bone is destitute of a keel, and the wings are quite rudimentary. Its tail is not lizard-like, as in *Archæopteryx*, but consists of about twelve vertebræ, of which the last three or four are amalgamated together to form a flat terminal bone. The tail seems to have been capable of up-and-down movement in a vertical plane, thus probably fitting this organ to serve as a swimming-paddle or rudder, and to aid it in diving. In one of his lectures Professor Huxley has spoken of these large extinct species as follows:—"They differ from all existing birds, and so far resemble reptiles in the one important character that they are provided with teeth; and it is in consequence of this discovery that we are obliged to modify the definition of the classes of birds and reptiles. . . . Before the production of such creatures as these it might have been said that a bird had such and such characteristics, among which was an absence of teeth, but the discovery of a bird that had teeth shows at once that there were ancient birds which in that particular respect approached reptiles more than any existing bird does."

Another remarkable "Ornitholite," as these bird-remains are called, has been found quite recently in the London clay in the Isle of Sheppey, a marine deposit rich in relics, brought probably from the neighbouring Eocene continent by some great river, whose embouchure was not far distant. This deposit had already yielded remains of *Halcyornis*, a supposed fossil Kingfisher, of *Lithornis*, a small Vulturine bird, of *Dasornis*, a Struthious bird of the size of the living Ostrich, of a small wading-bird, and of a longipennate bird, with wings as large as those of an Albatross. The fossil last found makes us acquainted with a strange saw-billed bird, probably a fish-eating one, like a Merganser, but in which the bony serrations (for they are not true teeth) were of large size, and when covered with a horny sheath must have been formidable organs of prehension. Professor Owen has named this remarkable bird *Odontopteryx toliapicus*.

From the Eocene slate rocks of the Canton Glarus, the skeleton, almost entire, of a small Passerine bird, of the size of a Lark, has been obtained, and from the gypsum quarries (Eocene) of Montmartre and Meudon, near Paris, several genera of birds have been described, such as the *Cryptornis* and the *Palæogithalus*, whilst the *Gypsornis* is described as the giant of the family of Rails, being as large as a Stork. Parts of more than one large fossil bird have been obtained from the Miocene deposits of the Sewalik Hills of India, whilst Madagascar has yielded three species of *Epyornis*, a wingless bird, whose affinities are clearly with the great wingless and extinct Moas (*Dinornis*) of the distant islands of New Zealand, once so abundant even within the period of occupation of those islands by primitive races of mankind. It is quite consistent, however, with what we already know of persistent types, to assume that the wingless birds (of which the *Dinornis*, the *Epyornis*, the *Apteryx*, the Emu, the Cassowary, the Rhea, and the Ostrich are representatives), have lived on from the Trias

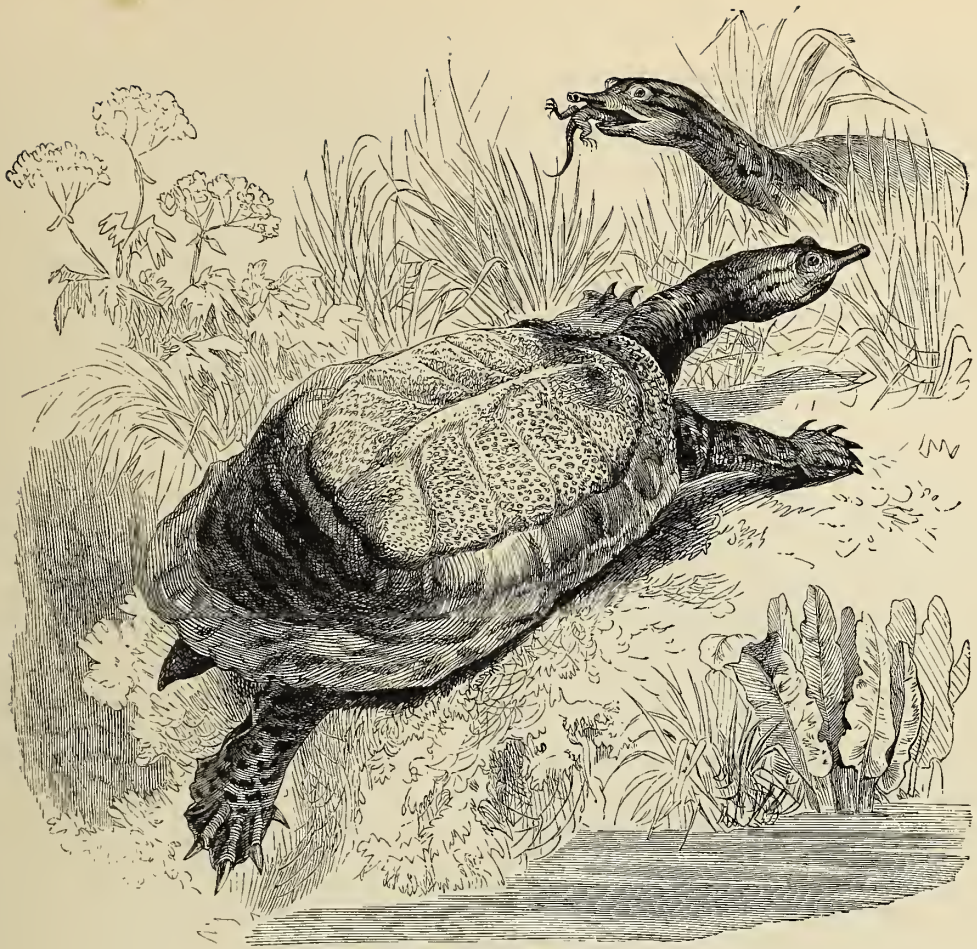
to the present day, having spread over the whole southern world, and in Eocene times passing north even as far as Britain (*Dasornis* from the London clay was as large as the Ostrich). The fish-eating birds, of which the *Hesperornis* and *Ichthyornis*, as well as the later *Odontopteryx*, are the illustrations, belong to a different type from the existing species, and if *Archæopteryx* is an ancient form of Perching-bird, the same may be said of that too. Within the last few years, in the deposits of the Paris basin, amongst remains of many genera which remain to the present day, have also been discovered relics of Flamingo-like birds, and even of a Roller (*Leptosomus*), a peculiar bird now restricted to Madagascar. Parrots were also represented in the Miocene formations, and a Guinea-fowl (*Numida*) has been discovered in the post-pliocene deposits near Salzburg, as well as *Necornis*, a defunct kind of Touraco from the bone-beds of Samson in Gascony.

In the recent deposits of the Mascarene Islands, the remains of the extinct "Dodo," "Solitaire," (*Aphanapteryx*), the latter being a gigantic flightless Rail with a long bill, Parrots, &c., mark the representations of the terrestrial fauna of a once extensive continent, now submerged, save the islands of Mauritius, Rodriguez, and Bourbon. In New Zealand, again, we have the Moas, the giant Gallinule (*Notornis mantelli*), a species perhaps not yet quite extinct, the extinct Flightless Goose (*Cnemiornis*), and an enormous bird of prey (*Harpagornis*), large enough to have preyed upon the Moas.

To conclude, let us ask this serious question:—Are the people of this and other countries doing their duty as regards the birds that live side by side with them? Within the last two hundred years many of the species mentioned in the present chapter were yet alive—the Dodo, the Solitaire, and no doubt the Moa—for in the British Museum are some feathers in a chief's weapon brought from New Zealand by Captain Cook, which could scarcely have belonged to any other bird but the *Dinornis*. It is by the hand of man, and principally of *civilised* man, that these interesting birds have been exterminated. "These lost species," writes Professor Alfred Newton, "there is some ground for believing were mainly, if not wholly, peculiar to the locality, and after having made good their existence, maybe for ages, fell easy and helpless victims to the forces which European civilisation brought into play. Chief among these forces was fire. In all countries and at all times it has been the habit of colonists to burn the woods surrounding their settlements, partly to clear the ground for future crops, and partly (in tropical climates especially) to promote the salubrity of their stations. When fire was set to the forest and bush of a small island, the whole of which could be burnt at once, the disastrous effect on its fauna can easily be conceived. Even the animals which happened to escape the conflagration itself would speedily starve, owing to the at least temporary destruction of the native flora whence, either directly or indirectly, they derived their wonted sustenance." And to these causes of destruction man now adds arms of precision, so that large game of all kinds fall to his gun or his rifle, or, retiring gradually before him, their original habitat knows them no more, and they ultimately die out. Nor is the fair sex above censure. For whose adornment are the beautiful Humming-birds of South America sacrificed in such countless thousands, so that their little bodies now form a staple article of trade to Europe, along with the lovely Rollers, Glossy Starlings, and Bee-eaters of Africa, and the brilliant Impeyan Pheasant of the Himalayas? Sure destruction awaits these birds, if not in our generation, at least in the next, for if the species can save themselves to a small extent by their wings, as the Dodo could not do, and the Apteryx cannot now, the firearms of the hunter more than counterbalance the advantages possessed by the hapless birds he pursues. Stronger measures than a "close time" for birds during breeding-season are needed, to contend against the persecution which attends them for the rest of the year; and nothing but the exercise of common sense and humanity on the part of men and women in civilised Europe can save many a beautiful bird from extermination. It is to be regretted that a fashion should prevail with even the most highly-educated of the fair sex, which has long been banished amongst men, excepting those of the most savage tribes. That the women of our own country may be the first to abandon the practice of decorating their wearing apparel with feathers and wings of birds, a fashion which causes immense slaughter in many countries, is the sincere wish of the writer,

R. BOWDLER SHARPE.

[NOTE.—Since this article was printed, a new specimen of *Archæopteryx* has been examined: its zoological position amongst the Birds is open to doubt.—EDITOR.]



THE SOFT-SHELLED TRIONYX.

CLASS REPTILIA.—THE REPTILES.

CHAPTER I.

THE CHELONIANS.

General Characters of Reptiles popularly so-called—Divided into Reptilia and Amphibia—**THE BUCKLERED REPTILES**—The Four Families—The Buckler of the Chelonians—The Carapace—The Plastron—Different kinds of Shells—"Tortoiseshell"—Protecting Bucklers—Feet—Shoulder-blade and Arm-joint—The Humerus (foot note)—Appearance of Tortoise's Head—The Process of Eating—Skull—Mouth and Jaw—Eye—Ear—Tongue—How Chelonians Breathe—Their Lungs and Heart—Digestive Organs—The Eggs—Extraordinary Vitality of Chelonians—Brain—**THE TORTOISES, THE LAND CHELONIANS**—Characters—**THE GREAT LAND TORTOISES**—Mr. Darwin's Visit to the Galapagos Islands—Enormous Size and Weight of the Tortoises—Probable Extinction—Distinctive Features—Habits—Great Tortoises at the Water-springs—Tortoises of the Mascarene and Aldabra Islands—Indian Tortoises—The Common or Greek Tortoise—African and American Species—**THE EMYDES, THE RIVER, OR MARSH TORTOISES**—Characters—The Terrapins—The American Box Tortoise—Habits—The Genus *Emys*—*Emys Europæa*—The Painted *Emys*—*Clemmys insculpta*—The Caspian Terrapin—The Snapping Turtle—The Chelodines—The Matamoras—The Snake-necked Tortoises—The "Aiyussa" Tortoise—**THE TRIONYCIDES, THE MUD, OR SOFT TORTOISES**—Characters—Habits—The Soft-shelled Tortoise—The Cryptopus—The Egyptian Trionyx—The Gangetic Trionyx—**THE CHELONIADES, THE MARINE CHELONIANS, THE TURTLES**—The Green Turtle—Habits—Size—Food—Egg-laying—How they are Caught—Characters—The Hawk's-bill Turtle—Why so Named—How the Tortoiseshell is Obtained—The Logger-headed Turtles—The Leather-back Turtles—The Sphargis—**EXTINCT CHELONIANS**—Classification of the Order.

WHEN a Tortoise, a Lizard, a Snake, a Crocodile, a Newt, and a Frog are seen together alive in a zoological garden, or stuffed in a museum, there is not the least difficulty in deciding that they, one and all, ought to belong to a particular group of the animal kingdom, and that they differ from all the other animals called beasts, birds, and fish. Whether they be alive or dead, they convey a

repulsive feeling to the mind, which is not felt on examining any other animal. In confinement, the general stillness of most, and the slow crawling motions of some of these creatures, stamp the whole with the title of creeping things, or reptiles. And when they are in their natural homes, where some display an activity of a singular and occasionally rapid kind, the word creeping is so very generally true to nature that the term reptile really does convey the difference between them and the other vertebrated animals. No one can confound any of these creatures with any of the Mammalia. Most observers of birds would object to their pets being compared with a reptile, and would say that, although the claws and scaly legs of many a bird are not without resemblance to those of the crawling things, there can be no satisfactory comparison between them and the feathered tribes. There is no difficulty in distinguishing between most fish and the reptiles.

Common experience, then, without troubling itself about the insides of the creatures, has separated those whose names were mentioned at the commencement of this chapter from the other animals with vertebræ or back-bones. Beasts, birds, fishes, and reptiles used to be the great divisions of the Vertebrata.

A visit to a collection of living or dead reptiles impresses one with the great number of kinds there are of them, and how very varied are their shapes and peculiar gifts. Some have limbs, others have not; some have a skin, most are scaled, and a few have a regular armour. They live on land and in fresh and salt water, and some indulge in a kind of flight. Some begin life in the water, and end it on dry land. If they are really to be divided from the other Vertebrata, it must be acknowledged that there are greater differences amongst them in shape and in method of life than there are in any of the other classes already noticed.

Very early in the history of comparative anatomy it was shown that the reptiles, popularly so-called, were cold-blooded, like fish, and that it was necessary, principally from the method of life in their youth, or on account of the changes which occur in the anatomy and physiology of their breathing apparatus during their growth, to separate them into two groups: the reptiles, to which belong the Tortoises, Crocodiles, Lizards, and Serpents; and the Amphibia, which in many instances lead at some time of their existence an aquatic life, and which may have tails, like Newts (*Tritons*), or which begin life with a tail, and lose it during growth, like the Frogs and Toads.

The Reptilia, or Reptiles, are cold-blooded animals, with back-bones, which have a scaly or bony-plated skin, which breathe by lungs, and whose heart has the ventricles not completely separated. They have a single occipital condyle to the back of the head, and they may lay eggs or produce living young. The existing reptiles are divided into several orders, some of which were represented in the ages of the past. They are the Chelonians, or Tortoises; Crocodilia, or Crocodiles; Saurians, or Lizards; Ophidia, or Snakes.*

ORDER CHELONIA.—THE BUCKLERED REPTILES.

Tortoises, Terrapins, and Turtles are familiar objects of natural history, and belong to an order of the reptiles called Chelonia.† These Chelonians are cold-blooded, four-footed reptiles, protected by a case, buckler, or shell, and without teeth in their jaws, and they are thus distinguished from all other animals. They usually lead monotonous lives, are numerous in individuals, and there are many genera and families of them. They are divided into four great divisions, and they frequent land, fresh water, and the sea. They have a great and remarkable geographical distribution, which, in some instances, is very suggestive to the geologist and physical geographer, and one group (the Turtles) is of commercial and gastronomic importance.

As there are Land Tortoises, Fresh-water Chelonians, mud-loving-ones, and Sea Turtles, the

* This multiplicity of great divisions indicates that there is very great variety in the reptilian class of structure and habits. It is also true that the kinds are very numerous, and that the genera are abundant. Many of the reptiles are never observed by experienced naturalists, and it may be said with great truth that the knowledge of the habits of the group is not so advanced as the knowledge of their anatomy. The classification of some of the genera is in dire confusion, the localities whence some important kinds come are not decided, and unfortunately it is too true that the life history of many is quite unknown. In the necessarily restricted space allotted to the reptiles in a work on natural history, which does not deal with advanced anatomy or elaborate classification, it is only possible to describe and notice well-known or typical kinds; and in doing this the works of Cuvier, Owen, Günther, Dr. Andrew Smith, Coues, Bell, Rymer Jones, Gray, and Huxley, have been freely quoted, and often to the very letter. In making this acknowledgment, it is trusted that the accidental omission, where such occurs, of the names of these distinguished naturalists will be forgiven.

† Chelonia, Tortoise.

order may be divided into corresponding families, under the separate titles of Testudines, Emydes, Trionycides, and Chelonians. The difference of shape and construction of the members of these "families" is clearly connected with their diverse methods of living. The kinds of some families swim freely; those of others swim and walk, or walk without being able to swim. Moreover, there is a connection between their habits and the food, some being carnivorous, others enjoying a mixed diet, and the rest being vegetarians. All lay eggs, and leave them to Dame Nature's care, and hibernation is common in all except the marine kinds.

The buckler of the Chelonians consists of a deeply-seated bony framework, the top of which, situated on the back of the animal, is called the *carapace*, and the underneath, placed below the body, is termed the *plastron*, or by some the *sternum*. There is in many Chelonians a shell which covers these parts, and is ornamented; and in one species this shell is the "tortoiseshell" of commerce. In others, however, it is not found, and its place is occupied by skin. Curious as these protecting bucklers are, they are still formed by structures which can be traced in most vertebrate animals, but which have been modified to suit the requirements of the Chelonians. The carapace on the top of the Chelonian is a modification of the bones of the vertebral column and ribs, and also consists of bony plates which, growing in the skin, unite all together.

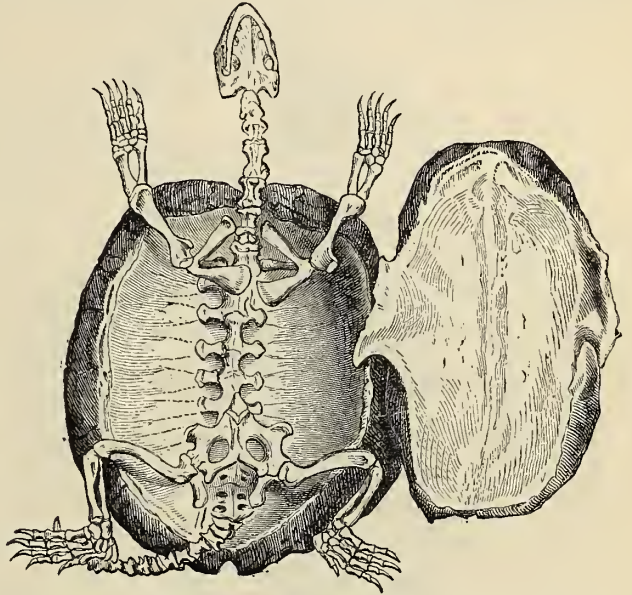
The spinous processes of the dorsal vertebræ and their ribs enter into the composition of the framework of the carapace, and a certain number of single and of paired pieces of dermal bones complete it. These dermal bones are called complementary plates, and single ones may be in the neck, in the middle line, or behind in the sacral region, whilst there are twenty-two plates on the sides, eleven being on each side. These accessory skin bones are called respectively *cervical*, *sacral*, or *pygal*, and *marginal* plates.

A careful examination of the inside of a carapace shows that the spinous processes of the second to the eighth dorsal vertebræ are flattened out, so as to form the middle of the buckler and compose the *median* plates. Then it appears that the ribs of these same vertebræ, and of the ninth also, are enlarged above so as to form eight long flat plates (*costal*), which are united with those in front and behind by toothed joints or interlocking sutures.

The expanded ribs also unite with the median plates, formed by the expanded spinous processes; and a portion of each rib may be seen underneath the plate-like part and projecting beyond it at the side of the carapace, and its outer or free end is received into a pit in one of the *marginal* plates.

But as the expansion of the rib passes to the spinous process to form part of the carapace, it is separated from the narrower part of the rib, which comes as usual from the side of the vertebræ. A space thus exists between the ribs and their expansions, and it contains the muscles of the back.

The under view of the carapace shows the bones of the dorsal vertebræ, which enter into its composition in the middle line; and on either side are the ribs, with their expanded portions filling up the spaces between them. A transverse section of the carapace shows that the breadth is greater than the height, as a rule, and that an upper arch is formed by the ribs and their expansions, and the expanded spinous processes of the vertebræ form the key-stone. The sides of the plastron are seen as curved lines; and at the sides is a marginal plate, connecting the plastron and rib.



SKELETON OF TORTOISE, FROM BELOW, SHOWING INSIDE VIEW OF CARAPACE AND PIASTRON.

A view of the carapace from above, when the ornamental part of the shell is removed, shows a row of expanded spinous processes in the middle line, flanked by the expanded costal plates which cover in the greater part of the carapace. At the edges of each of these is a projection narrower than they are, and it is the outward continuation of the rib. The ends of the ribs are fixed into a rim of marginal plates. There is a broad plate in the middle line (the nuchal) in front, connected on either side with the front marginal plate; and in some kinds, behind, there is a pygal plate in the middle line, and, like the nuchal, it is attached to the series of expanded spinous processes.

The under part of the buckler, or "the plastron," is not an outside development of the breast-bone or sternum, but is formed exclusively by skin or dermal bones, and usually consists of nine

pieces or plates, more or less developed. Of these, one piece is in front, and there are four pieces on either side, between which there may or may not be a middle space, which is closed by skin or by cartilage.

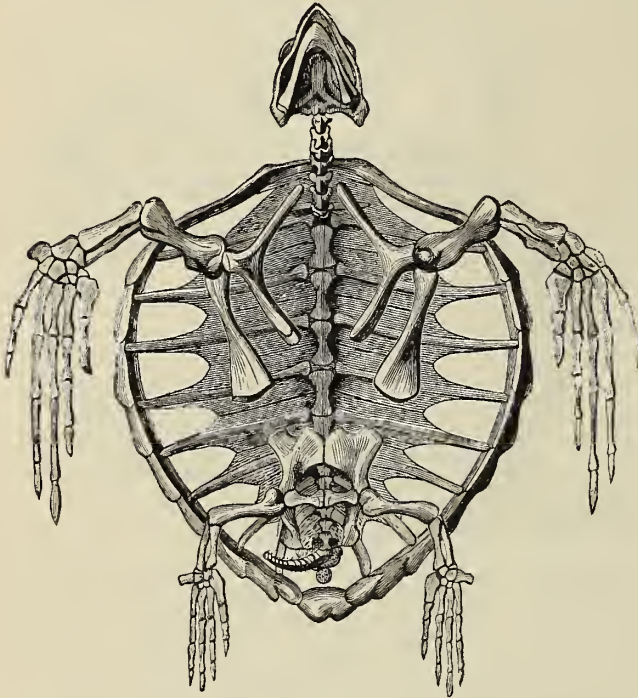
These different plates have received names which formerly were derived from the belief that this bone expansion was a breast-bone or sternum modified. Now it being believed that these bony pieces are all ossifications of the skin, or are what is called *membrane bones*, the names are different, and relate to the word plastron and their relative position.

It has been noticed that the spaces left between the plates of the plastron are filled up with cartilage in some Chelonians, and with skin in others; and it is readily observed that in the carapace of the Green Turtle, which has been taken as the example of Chelonian upper armour, the vacant spaces between the ribs and the marginal plates are also closed by cartilages.

Some of the Chelonians have enormous shells, and in others they are small

in relation to the size of the body; in some the texture of carapace and plastron is all bony, and in others it is gristly or cartilaginous, or bony, with a softer margin. The shells of some are flat, as in the Turtles; in others, as in the great Tortoises, the carapace is high and arched. Many Chelonians cannot retire the head, tail, and limbs within the protection of their shells, and others can do this perfectly. Most have the upper and lower parts of their more or less protecting cases soldered together at the edges, but in some there is only a cartilaginous or gristly union; and whilst in the majority the carapace and plastron are immovable in themselves, in some there is an amount of mobility in the plastron, by its having one or more unossified and cartilaginous parts stretching across from one side to the other.

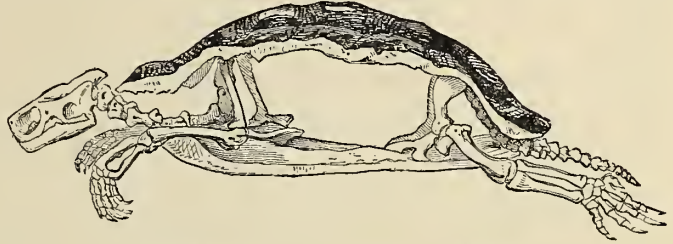
The carapace and plastron may be beautified by an outside covering, the "tortoiseshell," which differs greatly in its kind and ornamentation in the various groups into which the Chelonia are divisible. In many the well-known "tortoiseshell" covers over all the hind parts, and in some only a portion of the protecting case is thus ornamented. There are some Chelonians with a covering resembling leathern skins, and others have the plastron covered with soft skin. The "tortoiseshell," which is the ornamental horny covering to the carapace and plastron, and out of which hair-combs, knife-handles, and inlaid work are made, is to all intents and purposes an outside or scarf-skin



SKELETON AND CARAPACE OF THE LOGGER-HEADED TURTLE,
FROM BELOW.

structure belonging to the epidermis. It is in the form of thin plates, which are united together at their edges, and which correspond, to a certain extent only, with the underlying bones of the shell. The number, size, and position of these plates differ in all the great groups which possess them, and even in the genera and species, and so do their colours and ornamentation. In most there is a very geometrical configuration to the plates and to their grouping; and as large pieces of the epidermoid covering, or "tortoiseshell," are the best, those of the Hawk'sbill Turtle are the most in request. Usually, the position of the tortoiseshell plates is impressed on the carapace and plastron beneath them, the edges being recognised as indentations.

The breast-bone, or sternum, which is so well seen in Birds and Mammals, does not exist in the Chelonia, neither are there any sternal ribs; moreover, the vertebræ which enter into the composition of the carapace have no transverse processes. Only the ribs are present at the sides, and they arise between the body of the vertebræ and their neural arch, which is capped by the expanded spinous process.



SKELETON OF TORTOISE, FROM ONE SIDE.

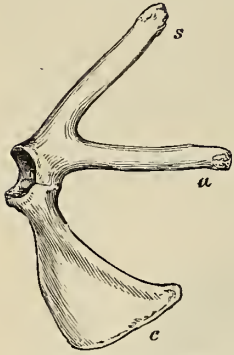
Consolidated and comparatively motionless as are the bones and plates of the carapace and plastron, this is not the character of the rest of the skeleton, for the neck, tail, and limbs can be active enough, and their anatomy is in accordance with their mobility.

A remarkable little Tortoise* has a long plastron, which can be bent across just behind the first quarter of its length, and it is broad and very close behind. There are openings for the head and neck, and for the four limbs, so that the armour is very complete. When the animal is alarmed, and withdraws its head and fore-limbs under the carapace, the movable front part of the plastron closes over their openings and effectually covers them; and when it desires to move again, the trap-door is opened by being lowered, and the head and fore-limbs can come forth. Another Tortoise,† belonging to the same great group of Land Tortoises as that just mentioned, has the carapace movable behind, but not the plastron in front, and the animal protects its tail and hind-limbs effectually by bending it down. But this protection does not take place through the agency of an elastic ligament, as in the Pyxis Tortoise, allowing the plastron to be bent. On the contrary, the plastron does not move, but the vertebræ, ribs, and plates of the hinder part of the carapace are not rigid, and can be bent down and curved by muscular action, so as to shut up the posterior openings, by approaching the back surface of the plastron. This last is rounded behind, and in its general construction it differs somewhat from that of these so-called Box Tortoises. One of the most perfectly protected Chelonians, although it belongs to a soft-skinned group called Mud or Soft Tortoises, has three holes in the back part of the united buckler. Amongst the Chelonians with incompletely protecting bucklers are the Turtles, for vast as their shields may be, still their head and limbs cannot be brought within them as in the Tortoises. Still greater want of covering is noticed in the Alligator Terrapin‡ of North America, and in the great-headed Platysternon of China.§

The feet are not heeled in the Chelonia, so that they have a hand-like look, and the ankle-joint beneath the tibia and fibula has only one bone, in contact with it in some kinds, and two in others. Four other bones are present in the Tortoise, which has five small toes, the little toe projecting from a metatarsal bone that sticks out from the foot. There is a good amount of fleshy padding under the fingers and toes in some kinds, and a web exists between them in others. The swollen appearance of the under part of the feet of the Tortoise is remarked by every young naturalist who has kept them as pets, and the nails are attached to the very short digits which seem like little excrescences. But other Chelonians, such as the marine and the fresh-water kinds, have well-developed fingers and toes, with webs and nails. The Turtles especially move with great grace, the hands and feet taking on a "feathering" motion, like paddles.

* *Pyxis arachnoides*.† *Kinixys Homeana*.‡ *Chelydra serpentina*.§ *Platysternon megacephalum*.

One of the peculiarities of the Chelonians is that instead of their shoulder-blade and joint for the arms being *outside* and upon the ribs, as they are in every other group of things possessing ribs and arms, they are *beneath the ribs* and *inside* the body. They are under the carapace, which is made up of altered ribs. The shoulder-girdle, of which the shoulder-blade forms, as in the Birds, a very important part, has a coracoid bone of great relative size, and there is a third large bone connected with the scapula, and which is called the acromion process. The girdle is a three-branched structure, and the cavity (glenoid) for the joint of the upper arm-bone is composed of a part of the scapula and part of the coracoid. There is no collar-bone, and as there is no breast-bone or sternum, the shoulder-girdle is hung, as it were, underneath the bodies of the vertebræ. The scapula, which is a cylindrical bone, is directed upwards in the proper position of the animal, and is hung to the body of the second vertebra of the carapace by a ligament. The coracoid is flat and more or less triangular, and is directed backwards in the body.* There is nothing like this tripartite incomplete girdle in any other order or class of the Vertebrata.



SCAPULAR APPARATUS OF
TORTOISE.
s, Scapula; a, Acromion Process;
c, Coracoid Process.

In the early stage of the existence of the Chelonia the girdle is not within the ribs, but in front and outside of them, but during growth the permanent position gradually prevails. This remark applies also to the pelvic bones and part of the thighs, for they, instead of being behind the ribs, are beneath and inside them in adults.

Everybody who has kept Tortoises, or who has had the opportunity of watching them in a zoological garden, must be struck with the shape of the head as it is slowly put forth from beneath its protecting shell. Its expressionless face, with its large nose-openings, meaningless eyes, and toothless, lipless jaws, is as remarkable as the apparently large brain-case, which is broad behind and very solid-looking. There is no external ear, but there is a tympanic membrane, which is visible in some kinds.

To see one of these sedate creatures eating does not give the impression that it is an easy or enjoyable proceeding. The piece of cabbage or other leaf is grasped in the wide gape of the jaws, which have a horny plate instead of teeth, and the motion of the lower jaw is simply up and down. The head is projected at each bite, and gradually the morsel is forced down the throat. It is evident, however, that although the creature is very slow in its movements it has very good eyes, and that it can detect its favourite food at once. Roaming about slowly, in search of food, the Tortoise turns its head but little to the right or left; nevertheless, it has the back of the skull well suited for movement, for there is a single condyle, as in the Birds, by which it articulates with the first bone of the vertebral column.



HEAD OF TURTLE.

On comparing the bones of this skull with those of the other classes, it is found that there are no nasal bones present, and that they are replaced by additions to the frontal bones, in the form of two pre-frontals. The parietal bones are largely developed, and are prolonged downwards as thin plates to the bone forming part of the front of the base of the skull or the basi-sphenoid. This prolongation occupies the place of the wing of the sphenoid bone (ali-sphenoid) in Birds. The pre-maxillæ are small and are usually united, and the vomer is single and forms a plate below on the

* The bones of the fore-arm joint with a humerus which is remarkable for its shape, which is adapted to support the weight of the body whilst the fore-limb is in movement. When compared with the corresponding bone of a mammal it appears to be out of its axis. The body of the bone is bent, the head of it is very rounded, and there are two knobs or tuberosities near it. One of these is located behind and above and the other is placed inwards and backwards. In the higher animals their position is internal and external, so that the Tortoise's humerus has, as it were, a twist. The lower part of the bone is wide and flat from before backwards, and there is a furrow along the outer border which is especially developed in the marine Chelonians, but less so in the fresh-water kinds, and least in the Tortoises. The marine Chelonians have not the bent condition of the humerus noticed in the land kinds, and the difference relates to their very different mode of life.

hard palate, and joins the palatine bone on either side, to form a very solid piece, behind which is the opening of the inner nostril. There is a post-frontal bone, which, with the squamosal of the ear-bone, occupies the upper part of the temporal region, and the last-named bone is placed at the side of the ear-capsule and above the quadrate bone. The pterygoid bones of the base of the skull and hard palate are behind the nostril, and are united together, and with the quadrate bones also. There is no transverse bone.

All these bones, most of which, but not all, are comparable with those of the Birds, are united together immovably, and the solidity of the skull is great. In the Turtles, and in some of the Terrapins, there is a false roof to the skull, produced by a flattening of the parietal ridge and its union in front with the post-frontal bones and behind with the squamosal. It is this which gives the large and solid appearance to the head. The skulls are nearly all face and outside, and the brain-cavity is very small.

On examining the mouth of the Tortoise a sharp edge of horn is felt; and it is noticed that the mandible is very solid, and that it unites with the head-bones far back, and after the fashion of the Bird rather than of the Mammal. There are traces of all the different bones which make up the lower jaw, on either side, in the Birds, to be found in the Chelonia, but they all become solidly united at an early age. In the Tortoises there is union at the chin, and the dentary bone resembles that of the Bird, but the Matamora of North Brazil is said to have the front bones of the lower jaw separate.

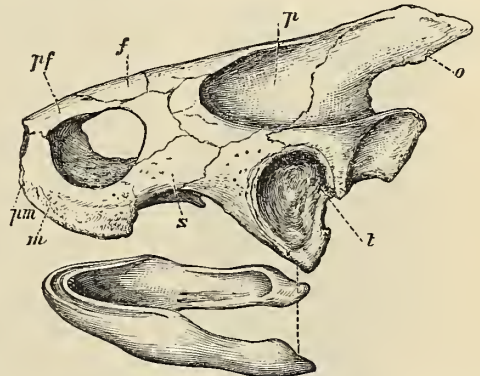
The jaw-joint, which moves on the skull on either side, is fitted into a wide and large quadrate bone, which is fixed to the skull, the mammalian method of articulation not being seen, but that of the Bird being closely followed. Teeth are absent in the group, but in some kinds the horny substance of the jaws is irregular and saw-like, and the front may be produced into a kind of beak.

Sight is evidently keen in most Chelonians, and the eye is a very elaborate organ, provided with eyelids, a nictitating membrane, and well-developed tear glands. There is much perfection of the movement of the eye-ball, and there are six powerful muscles, and four smaller ones, which embrace the optic nerve and are expanded over the ball behind. There is the same considerable convexity of the cornea, and the smaller convexity of the rest of the front of the eye in the Chelonians which was noticed in the Birds, and singularly enough the plates forming a bony ring of separate pieces seen in some of these last are present generally in some of the Chelonians. The iris is circular in the order.

The internal ear has the same important parts as in the Birds, and there are a tympanic cavity, a rudimentary cochlea, and three semicircular canals. The Eustachian tube of the higher animals is represented, and particles of a calcareous nature, called otoliths, are found in the sac-like cochlea. The vibrations of the tympanic membrane, which is visible at the side of the skull, are transmitted to the internal ear by one little ossicle instead of by three, as in the mammalia. It is said that some of the gigantic Tortoises are deaf.

The sense of taste must be reduced to the utmost in the Chelonia, and the tongue is covered with a thick rugged membrane, smooth in the Turtles, but beset with pointed papillæ in the Great Tortoises. A number of glands exist beneath the membrane, and supply the mouth with a moistening secretion, and the tongue is supported by a hyoid bone, which is cartilaginous, and sends a little bone into the centre of its substance—the lingual bone.

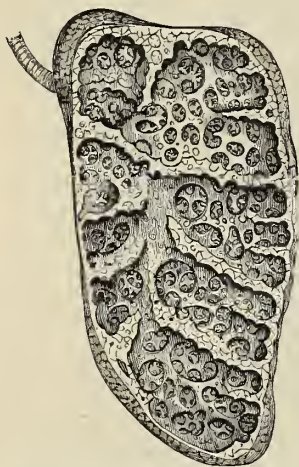
The hyoid bone is of great importance in the Chelonians, for it not only has to do with the tongue, but it also assists materially in the mechanism of breathing. Mammals and Birds breathe by having air drawn into their lungs by means of the expansion of their ribs and the movement of their chest by muscles, and by expelling it through the reverse movements, and by the elasticity of the lung itself. Now, Chelonians have no movable ribs, and the muscles are either wanting or are



SKULL OF TORTOISE.

pm, Pre-Maxillary; m, Maxillary; pf, Pre-Frontal; f, Frontal; p, Parietal; o, Occipital; t, Tympanic; z, Zygoma.

positively within the chest. Watch the land or water Chelonians, and they seem never to breathe; it is only when these last have been under water for some time that bubbles come up from their mouths. There is no vigorous chest movement resembling respiration. In fact, the Chelonian lungs have air forced into them by a process not unlike that of swallowing. Keep a Tortoise's mouth open too long, and it will be suffocated for want of air, or close the nostrils, leaving the mouth free, and the same result will follow. The Chelonians breathe by keeping the mouth firmly closed, and by the action of certain muscles in the throat, some of which pull down the hyoid bone and the bone of the tongue, and others which restore it to the usual position. The hyoid bone being dragged down, air rushes in at the nostril, gets into the mouth, and then the tongue closes the internal nostril, whose position is at the back of the palate. Then, as the bone and tongue are moved upwards again, the air is forced down into the lungs, and the air-cells are filled. The expiration of the air is produced by the collapsing of the air-cells, and it passes slowly upwards through the main air-tube to the mouth. The breathing is very slow. In the Chelonians, and all Reptilia, the midriff muscle is absent, the chest and abdominal cavities being continuous, and all the viscera are covered with a membrane, called pleuro-peritoneal.



SECTION OF LUNGS OF TORTOISE,
SHOWING CELLULAR ARRANGEMENT.

The lungs of the Chelonia are large and occupy much space; in some, as in the Alligator Terrapin, they are divided into several compartments, and the air-cells and the breathing-surface generally appear to be the most complicated near the entrance of the main air-tube. Like those of all Reptiles, the lungs of the Chelonians contain cold blood, and the chemical and physiological changes in it are incomplete and slow. No brilliant red stream is passed from the lungs to the heart in the Reptiles, for the blood therein flowing is dark—a mixture of oxygenised and imperfectly aerated blood—and it is sent forth in that state by the ventricle of the heart all over the body and into the lungs. The auricles of the heart, which are very capacious in the Chelonia, are situated above and before the ventricle, and are divided by a partition. The ventricle—for there is only one—is muscular, and the blood rushes from the two auricles into it and gradually distends it. In the Common Tortoise the ventricle is little more than a simple cavity, but in the Hawk's-bill Turtle the cavity is divided into several communicating compartments by muscular projections and fibres, which strengthen the whole. But in both and all other instances the ventricle, by its contraction, expels the blood, not into the auricles again, but through a series of blood-vessels, namely, two distinct aortæ, a right and a left, and a main vessel for the lungs or pulmonary artery. The blood of the great veins is thus mixed in the ventricle with that from the lungs, and the mixture of oxygenated and non-aerated blood is sent forth, some of it to the body, and some to the lungs. The two aortæ pass backwards and unite opposite the fifth dorsal vertebra, and thence but one vessel is continued to supply the body.

Besides the system of veins and arteries, the Chelonians, as well as all Reptiles, possess large sets of lymphatics, and they open into the great veins of the neck on either side.

The blood corpuscles of the Chelonia, and of all Reptiles, are elliptical in shape, and are larger than those of the Birds and Mammalia; probably those of the Tortoise are $\frac{1}{132}$ of a line long and $\frac{1}{195}$ of a line broad. And experiment has shown that the temperature of the blood and of the animal is very slightly above that of the air or water in which it may be placed for a while.

Although some Chelonians can last without food for many months, others feed constantly; and whilst some enjoy vegetable substances others are carnivorous. Hence there is some diversity in the structure of the digestive organs; but it is only necessary to state that the flesh and insect-eating kinds have a shorter intestine than the others. In all there is a capacious gullet and œsophagus, but there is no crop. The muscular coat of this passage is strong, and in the Turtles the inner surface is lined with long, hard projections pointing towards the stomach, denying return to anything which has gone down. The stomach is long, thick, cylindrical, and bent; its walls are very muscular, and it is closely connected with the liver, that of an American fresh-water kind (*Emys concinna*) being imbedded in it.



GIGANTIC LAND TORTOISES FROM THE GALAPAGOS ISLANDS. (Modified after Günther.)

(1) *Testudo ephippium*; (2) *Testudo microphyes*; (3) *Testudo abingdoni*.

Laying eggs, the Chelonia have them of a calcareous nature outside in the Land Tortoises and fresh-water kinds; but the Turtle's eggs are leathery, or like parchment to the touch. The construction of the egg-producing organ greatly resembles that of Birds; and it is only necessary to state that the internal structure of the egg and the development of the young in its early stage differ in no very essential circumstances from those of the Bird. The carapace and plastron appear before the egg is broken by the outcoming Chelonian.

There is a wonderful amount of vitality in the Chelonians, and, indeed, in many other Reptiles. Some can live for many months, and it is said years, without food, and it is well known that movements and indications of life remain for a considerable time after the head has been removed from the body or the brain from the head. Their lives are very much the same year after year and generation after generation; their passions are cold-blooded, and there are no permanent displays of the affections. Hence the brain and spinal nervous system are less developed than in Birds, and they are small for the size of the head and body. The surface of the rather long brain is smooth, and there is a projection in front—the olfactory lobe—which is hollow; the optic tubercles are rounded, and are separated by a deep fissure; the cerebellum is nearly hemispherical, and the fourth ventricle is well developed. Finally, the sympathetic or organic system is feebly developed in the Chelonia.

FAMILY I.—THE TORTOISES.—THE LAND CHELONIAN.*

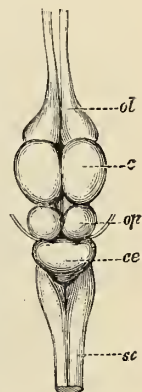
These have the carapace and plastron bony, and covered with shelly plates, and the buckler as a whole is swollen above. They can retract the head, neck, and extremities within its covering, and they live on land.

THE GREAT LAND TORTOISES.

When Mr. Darwin visited the Galapagos Islands, he saw the relics, as it were, of a family of huge Tortoises, which lived there in abundance a few years before, and was able to verify many interesting facts which had been recorded by Porter, in his "Journal of a Cruise Made to the Pacific Ocean in 1813." Porter noticed the deafness of the huge creatures, and, like former voyagers, was impressed with their enormous size, with the long necks of some, and with their quick sight and ponderous movement. He stated that some of the Tortoises captured by him weighed from 300lbs. to 400 lbs., and that on one island they were five feet and a half long, four feet and a half wide, and three feet thick in the body. They walked with the body about a foot from the ground, and the females seemed to preponderate. It is quite evident from Porter's narrative that several kinds lived in the islands, those of one island differing from those of another, but all being of the same group of Tortoises. He expatiates on the luscious and delicate food that the long-necked and small-headed and other kinds produce, and notices their ability to last long without food. After Mr. Darwin's visit the progress of extirpation went on, and in eleven years Mr. Seeman, naturalist on board H.M.S. *Herald*, found that on one island there were no longer any Tortoises, and that everywhere they had diminished in number. At the present time it is most probable that the gigantic Tortoises are very rare where they were formerly so abundant. There were five species there a few years since.

These Galapagos Tortoises were of several kinds, each inhabiting especial islands in the Archipelago, and they can be recognised in museums and in the few living specimens which have been brought to Europe by the black colour of the shell, the thin condition of the bony carapace, the general lightness of the huge buckler, and by the usual front plate being absent, so that their long neck can be raised up, carrying the head above the level of the body. The legs are long, and there is a remarkable plate or scale on the inner side of the elbow.

They have flat-looking and small heads, and usually there is a very decided crest of bone at the top and back of the skull. Dr. Günther described four important species of this group, and states that in James Island, *Testudo elephantopus* and *Testudo nigrita* were the only kinds, and perhaps only the first-named; and he has evidence to prove that King Charles Island was inhabited by *Testudo ephippium*,



BRAIN OF A CHELONIAN.

ol, Olfactory Lobes;
c, Cerebrum; op,
Optic Lobes; ce,
Cerebellum; sc,
Spinal Cord.

* *Testudines*.

and Hood's Island by *Testudo microphyes*. The first of these Tortoises has been known to have a carapace three feet in length and forty inches in breadth over the top. The limbs are large and long, and the feet huge; moreover, the erect neck allows the head to be moved here and there, and to use Dr. Günther's expression, in a manner not unlike that of the Cobra di capello. The bones of the wrist and the fingers are broad and short, the scaphoid and intermedium being united, and the whole is elephantine in its proportions. *Testudo nigrita* had a nearly circular carapace as large as that of its fellow.

Moseley states that some of these Tortoises were on board the *Challenger*, and were fed on pine-apples, a number of which were hung in the paymaster's office. The animals used to prop themselves up against a board put across the door to keep out dogs, and unable to surmount the obstacle, used to glare and sniff longingly at the fruit. They, moreover, used to make their way along the deck to the captain's own cabin, where there was a store of the same fruit.

The Great Tortoises are very fond of water, drinking large quantities, and wallowing in the mud. The larger islands alone possess springs, and these are always situated towards the central parts, and at a considerable elevation. Near the springs it was a curious spectacle to behold many of these great monsters; one set eagerly travelling onwards with outstretched necks, and another set returning, after having drank their fill. When the Tortoise arrives at the spring, quite regardless of any spectator, it buries its head in the water above its eyes, and greedily swallows great mouthfuls, at the rate of about ten in a minute. The inhabitants say that each animal stays three or four days in the neighbourhood of the water, and then returns to the lower country; but they differed in their accounts respecting the frequency of these visits. The animal probably regulates them according to the nature of the food which it has consumed. It is, however, certain that Tortoises can subsist even on those islands where there is no other water than what falls during a few rainy days in the year.—(*Charles Darwin*).

One of these Great Tortoises* is that of Abingdon Island, in the Galapagos Archipelago, and there is a fine specimen stuffed in the British Museum. It has a very long neck, a small flat-topped head with a short snout, and the front of the jaws is straight up and down. It had originally the weight of 201 lbs., and, like the others, is sought for on account of the oil it contains.

None of these huge Tortoises are known on the mainland of America, which is the nearest continent, and it is a remarkable and most suggestive discovery that their nearest allies in size and structure formerly lived thousands of miles away across the great Pacific Ocean, in the Mascarene Islands, the Island of Rodriguez, and also in the Island of Aldabra, to the north-west of Madagascar.

The Great Tortoise from Aldabra, specimens of which have been taken to the Seychelles and acclimatised, is round-headed, and has a convex skull, and the beak is, as it were, trenchant. The third cervical vertebra is bi-convex. Now the Great Tortoises of the Mascarene Islands, but lately extinct there, although closer geographically to those of Aldabra Island than to those of the remote Galapagos Archipelago, resemble these last more than the others. They have a very thin carapace and a flat head; moreover, their plastron is short. So that although their anatomy closely resembles that of the Galapagos Tortoises their configuration differs.

There is a fine specimen of a huge Tortoise from Aldabra Island, which once weighed 870 lbs., in the British Museum, and it is called *Testudo elephantina*. A living one is in the Zoological Gardens.

The Tortoises found in India are not of very large size, and number three species; [the so-called Indian Tortoise, which attains a length of four feet, does not come from the mainland, but from Aldabra Island]. One of them is the Elegant, or Starred Tortoise, whose shell is of a black colour with yellow areolæ, with yellow streaks radiating from them, those running towards the corners of the plates becoming gradually wider.† The plates are often humped on the back, and deep cavities exist at those places inside. It attains the length of twelve inches, and is found in many parts of the peninsula of Southern India and Lower Bengal.

Captain T. Hutton states that in some places where these Tortoises are found in hilly tracts and in the high grassy jungles adjoining them, they are not readily procured, because their colours and those of the surrounding rocks are blended. They remain in concealment beneath tufts of grass during the heat of the day, but the Bheels, who are expert in tracing their footsteps, generally succeed in catching them. These Tortoises came out, when in confinement, a little before sunset, to feed on grass, cabbage,

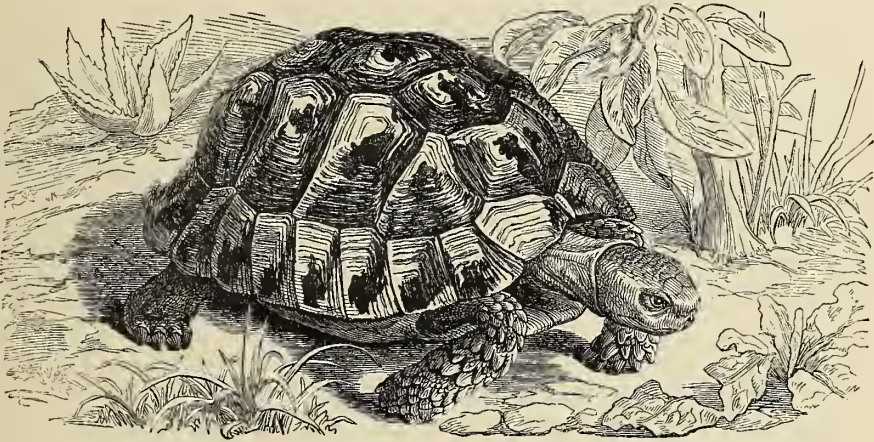
* *Testudo Abingdoni*.

† *Testudo elegans* (Schöppf).

or lucern, and they remained out and quiet during the night, as if enjoying the cool air. They were fond of plunging into water, where they would remain for half an hour, and they drank large quantities by thrusting their heads in and swallowing it by draughts. During the rainy season they were much more lively, and wandered about, and when the laying season commenced, in November, the female moistened some earth at the selected spot, made mud of it, and then scraped it away until a pit was formed. In two hours one had made a hole six inches deep and four inches in diameter, and in this she deposited her eggs, four in number. She filled up the hole, and beat down the mud with the whole weight of her body. They did not burrow when they became quiet in the cold season, but were listless, though not torpid.

The males butt against each other and make much noise, and strive against their adversaries in trials of strength. Sometimes they tilted each other over, and there was great difficulty in getting on the legs again. The next Tortoise is the Afghan Tortoise,* which has four claws in front; and the last is the Burmese Tortoise,† with a long shell and five claws in front, and it is found in Camboja, Arakan, and Mergui.

A Tortoise, which is imported into England and sold in considerable numbers, and which is made



THE COMMON OR GREEK TORTOISE.

a domestic pet, comes from most of the countries bordering on the central and eastern part of the Mediterranean Sea, Greece, Turkey, Asia Minor, Palestine, and Dalmatia. This kind is also found as far north as the Danube, Italy, and the islands of Sardinia and Corsica, and it is said also to live in the Balearic Islands, the South of France, Switzerland, and even farther north. But it is difficult to decide its correct natural limit, for this *Testudo Graeca*, or Grecian Tortoise, has long been an object of interest and commerce, and may have been introduced into countries beyond its natural position.

Like all the members of the genus *Testudo*, which is the most important one of the family, this familiar creature has a buckler on top and underneath, which are commonly called the shell, and they are united and solid, having openings in front and behind for the neck, arms, legs, and tail. It is a slow-moving creature, and it withdraws its head and limbs within its buckler on any great alarm, and remains passive and safe until the danger is past. It travels at night as well as by day, and those people who keep one in their garden will generally find that their succulent and nicest vegetables are attractive to it. This Tortoise recognises its kind feeder; but it certainly will try and get out of the way of children, who place it often on its back, and enjoy its curious struggles to return to the proper position. The pet Tortoise disappears in the late autumn, and reappears in the spring, having buried or hidden itself under garden refuse, and having enjoyed a quiet winter's sleep; and they live for many years. They dislike the wet, and evidently seek the shade when the sun is very hot.

* *Testudo Horsfieldii* (Gray).

† *Testudo elongata* (Blyth).

The peculiarities of the Tortoise were well known to the ancients, and a military machine used in besieging towns was called after it, and the curious story about the death of the tragic poet Æschylus, already noticed in mentioning the habits of the great Lämmergeier, testifies to the acquaintance of the ancients with the solidity of this bucklered reptile.

The Ethiopian region of natural history has the greatest number of species of Tortoises, and the Leopard Tortoise,* the Grooved Tortoise,† and the little Geometric Tortoise‡ are familiar examples. The last Moseley noticed as loving the sandy and arid districts of the Cape of Good Hope, and he states that they may be tracked by the marks they leave on the soil. They are caught, and their little shells are made into paper weights, being first of all filled with lead. The Radiated Tortoise§ is from Madagascar. There are no true Tortoises in Australia. The American species, including the Great Tortoises found on the Galapagos Islands, are the Gopher Tortoise from North America and Mexico, and the Brazilian, Black, and Argentine Tortoises from South America.|| There is a Tortoise in Chili, Northern Patagonia, Mendoza, the Pampas, Monte Video, and Buenos Ayres, which resembles in its colour and general appearance one from the very distant regions of Abyssinia. But this American Chilian Tortoise (*Testudo Chilensis*) has a more depressed shell, and the marginal and chest plates differ from those of the African kind.

The Gopher has its most northern limit on the western border of South Carolina, and they are found in Georgia, Alabama, and the Floridas. The adults are strong, and can move a weight of some hundred pounds or more, and in the wild state they seek their food by night. They like dry and sandy places, and are abundant in poor and barren countries. They are fond of the sweet potato, and go into their holes in the heat of the day. They dislike rain, and retreat on a shower commencing. As the cold comes on they hibernate, but a few warm days will restore their activity.

The remaining groups of the Tortoises have already been noticed in explaining the mobility of the plastron and carapace in certain Chelonians. They constitute the genera Pyxis and Kinixys, and may be called the Land Box Tortoises, in contradistinction to some others which lead a more or less aquatic life, and which belong to other divisions of the order.

FAMILY II.—THE EMYDES.—THE RIVER AND MARSH TORTOISES.

These Chelonians lead, with one or two exceptions, a land and water life. Their limbs are slenderer than in the Tortoises, and their digits are united by a web for swimming purposes. As a rule, the carapace is flatter than in the land group, but it is bony, and there is a well-developed horny covering

The family may be subdivided into two groups. In one the head and fore limbs can be withdrawn under the shell, and in the other the neck is so long and the buckler is so small that the usual shelter is incomplete. Nevertheless, the members of this last group do manage to get their heads under cover of, but not within, the carapace and plastron.

An example of the first group—the Terrapins—which are very common in the United States, is the American Box Tortoise. It is familiarly known as the Carolina Box Tortoise (*Cistudo Carolina*), and in other and different localities as the Virginian or Mexican, and from its ornamentation the Ornate, or Chequered Tortoise. This animal has a very wide distribution in the United States and in North America, from Maine to Florida, westward in Texas, Iowa, and Missouri, and in Mexico, and can be recognised among its fellow Emydes by its singularly terrestrial habits. It rarely frequents marshes, and probably never the water, but it is found in dry, hot, pine forests and on mountain ground, looking after beetles, grubs, and, it is said, snakes. The slightly-arched and keeled carapace is about five inches long and four broad, and is broadest behind. It is of a rich brown or brown-black tint, and has yellow spots or stripes. The plastron, movable before and behind, is yellow or brown, and there is the usual hood to the neck, out of which the head peeps and returns, more or less, as within a glove-finger. Many years since Mr. Ord described the habits of one from Pennsylvania, which managed to get its living in rather a parasitical manner. It was found feeding

* *Testudo pardalis*.

† *Testudo sulcata*.

‡ *Testudo geometria*.

§ *Testudo radiata*.

|| *Testudo polyphemus*, and *Testudo tabulata*.

on the leavings of the Night Heron, and enjoying the little bits of fish which had dropped from the bird's beak, and which the Heron did not consider worth picking up. It prefers its food in a half putrid state, and searches also for insects and worms. Mushrooms, peaches, strawberries, and raspberries are not despised by this omnivorous creature, but this mixture of food renders this edible Terrapin anything but a favourite food, although its flesh is said to be excellent. Like most of its family, this *Cistudo* hibernates. It seeks a warm loose soil with a southern aspect, often under a heap of decayed brushwood, and digs down beneath the surface in the middle of October. There it lives—unless the weather is very severe, when many die—until the middle or latter end of April, in a torpid condition. It comes forth very feeble, and soon begins to move if the sun is shining warmly. After a while it seeks a soft place, digs down, makes a deepish little hole, and lays an egg, which it covers with a little earth, using the hind feet. Then another is laid and covered up, and at last the laying is finished, and the mother covers all, and treads the ground down so that the nest is found with difficulty. The young when just hatched are soft and cartilaginous.

The genus *Emys* belongs to this group, and is very rich in species, which inhabit all the temperate and tropical regions, except Australia. They cannot well exist without water, and they abound in the still waters and tanks of the lower parts of India, often remaining motionless on the water, the shell and the snout above it and the rest below, and they disappear at the approach of danger, darting away with great rapidity. Their pointed claws enable them to crawl easily over slippery and steep places, and dig little holes for a small number of long hard-shelled eggs, which in some species are from eighteen to twenty months in hatching. They are chiefly carnivorous, and the flatter the shell, the broader the foot-web, and the more jagged the jaws, the more aquatic and destructive are the habits. They live on tender insects, frogs, small fishes, little birds, and small mammals, and are in turn hunted and eaten by Crocodilia and large fish. They are easily kept in captivity, provided that they are placed in a tank, and fed with meat cut into small pieces or with frogs. The head and feet can be retracted within the carapace.

Of these the Ocellated Pond Tortoise* approaches the Land Tortoises in its habits and in several characters, and has a brownish shell, with "eye" spots of a chestnut-brown with a light edge, and the lower parts are yellow. It comes from Margui and the Tenasserim coast. China yields the Speckled *Emys*, about five inches and a half long.† The Thurgi‡ is large, over twenty-two inches in length, and the jaws are denticulate. It is highly carnivorous, and comes from the Ganges. The Yellow-spotted *Emys*|| comes from the same river, and has been brought to Europe. Finally, the Ceylonese Pond Tortoise§ is common in Ceylon as well as in the peninsula of Hindostan, and the shell is uniform brown and the plastron brown-black in colour. The Pangshures are confined to the Indian continent, and have the buckler solid and entirely bony. The feet are broadly webbed, and the claws are of moderate size, five in front and four behind. The common one is found in the Ganges and other Bengal rivers. It is known by its elevated back, and the yellow colour and black spots of the lower parts of the shell. The Batagurs have the carapace depressed, and the claws are feeble. One which reaches the length of twenty inches is thoroughly aquatic, and is found in the Ganges and Irrawaddy. It abounds in the Hooghly, and is sold for food.¶

The genus *Emys* has species also in Japan and the Holy Land.

The Chicken Tortoise** of the United States probably belongs to this group, and is dark brown, with a yellow vertebral line. All the plates are marked with yellow lines, and they communicate to give reticulate appearance. The shell is nine inches and half long. It inhabits ponds and stagnant waters, and may be seen swimming slowly from place to place, the head and neck only being visible. They bask on limbs of trees, and plunge in at the least noise. They inhabit North Carolina, Georgia, and Florida.

The *Emys Europea*, a great lover of fresh water and marsh land, is to be found in South-eastern Europe, and in Italy, Switzerland, the South of France, Spain, and Algiers. It formerly was not uncommon in the neighbourhood of the Oder, Elbe, and Danube, and it extends into Persia. A small, flat, rather round-bucklered and long-tailed, bright-eyed, yellow-spotted, lively little thing, is this *Emys*, and it is often sold in England as a pet. It is brown-black on its flat carapace, but the few small yellow spots distinguish it at once. The toes, five in front and four behind, are webbed to a certain degree,

* *Emys ocellatus*.

† *Emys Bcalii* (Gray).

‡ *Emys Thurgi*.

|| *Emys Hamiltoni*.

§ *Emys trijuga*.

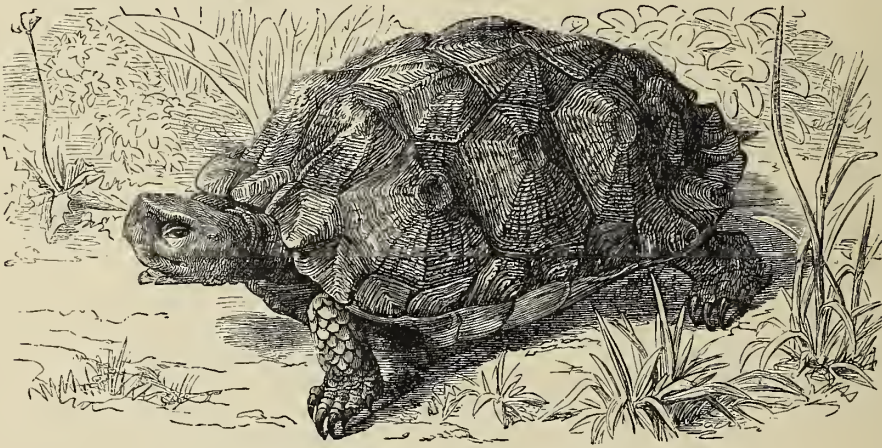
¶ *Emys tecta* (Gray).

** *Emys reticulata*.

and the claws are sharp. The carapace and plastron are solidly joined, and the first has twelve shell-plates. There are two scales in the arm-pits and two in the region of the groin. These little *Emydes* are killers and eaters of small fish, beetles, and other insects and worms, but they will occasionally eat bread and vegetables: and to their cost, for when thus nourished they are occasionally made articles of food for man. They like stagnant water, and do not go far from the banks; they hibernate in the winter, and dig down and bury themselves in the mud at that season. It is said that their eggs require a whole year to incubate and hatch. The buckler gets more oval with age, and may reach eight inches in length and five in width.

The Painted *Emys* (*Emys picta*) is a well-known kind in the Eastern and Middle but not in the Southern United States. It has a broad yellow band, limited by a black line, extending along the front of the scales, and the margin of the carapace has blood-red blotches on it. It has a large web to the feet, and is very aquatic, dying if kept many days out of its favourite element.

Another and allied genus is *Clemmys*, of which *Clemmys insculpta* is found from Maine to Pennsylvania. It is not always found in and near water, for it is a great wanderer, and makes its way to the forest.



CLEMMYS INSCULPTA.

Another of this widely-spread genus, which is often made to replace that of *Emys*, is found in Europe and Western Asia. It is the Caspian Terrapin,* with a pale olive back and indistinct paler, yellowish, reticulated lines, edged with black. The plastron and under-side of the margin are black, with irregular-sized yellow spots on the outer side of each sternal shield; the head and neck are olive, and the throat and sides of the neck have black-edged pale streaks. The upper beak-like jaw has a slight acute central notch and a tooth-shaped process on either side.

Another important genus of this group is *Kinosternon*, in which the fore and aft part of the plastron are movable, after the fashion of Water Box Tortoises. They are popularly called Double-flapped Box Tortoises. The Pennsylvanian Mud Terrapin is the example.†

The well-known Alligator Terrapin,‡ or Snapping Turtle, belongs to the genus *Chelydra* of this family. It has a comparatively small buckler, but it is provided with a plated head, armed with a hooked beak. The claws are, moreover, strong, and the tail has a crest on it. There are two growths or barbules under the chin. This is an active swimmer, and is very destructive of fish and even young birds. They grow to a considerable size, for some measure twenty-four inches, and the longest attain four feet in length. The weight of 20 lbs. is not uncommon. They are found in stagnant waters or shallow pools, but generally prefer deep water, and live at the bottom of rivers; and when they come to the surface, they elevate the tip of the pointed snout and float along with the current, going to the bottom at once, if disturbed. They are very voracious, feeding on fish, reptiles, or any animal substance that falls in their way. They take the hook when fished for, and require much

* *Clemmys Caspica*.

† *Kinosternon Pennsylvanicum*.

‡ *Chelydra serpentina*.

management to get them to land. When they leave the water they may be seen on the banks of meadows, with the head, neck, and long tail extended, and after a short walk they fall on their chest, as Alligators do. They are ferocious during captivity, and bite at everything. They are excellent food, and are very widely distributed in nearly all parts of the United States.

One of these aquatic Emydes attains a considerable size, and has a long neck and tail and flat body. The snout is long, and there is a sharp beak on both jaws. There are armour plates on the head, and three strong ridges on the carapace. It is a very active swimmer, and preys upon small fish, and is called Temminck's Snapper.*

The Large-headed Chinese River Tortoise,† with a long flat buckler and a very long tail, lives in the swamps, marshes, and streams, and is sometimes sold in Canton.

Its habits are probably those of the others of its group, and its powerful upper and lower beak would enable it to catch and hold fish. The head is plated, the eye is large, the limbs are scaled, and there is a long tail, which, when the animal is at rest, is curled up under the right margin of the carapace. Mr. Swinhoe kept one alive during the winter at Canton, but it did not eat any food.

The next division of the family Emydes is called the Chelodines, and contains kinds which cannot withdraw the head; the neck bends sideways, and is then stowed away under the overhanging carapace, but not within the plastron. The carapace and plastron are united to the pelvis. Two or three of the species may be noticed. One has been alluded to in describing the general anatomy of the Chelonia as presenting many anomalous characters; it is the Matanata (*Chelys fimbriata*), which grows to a considerable size in Guiana and North Brazil, living in the stagnant pools near the Orinoco and Amazon, or in still water, or in the swamps. It lives on fish and small water-birds, and is a good and quick swimmer, and when it is quiet the peculiar barbules of its head attract fish, for they are not indifferent imitations of worms when in slight movement. The head of this curious animal is depressed, wide, and triangular in outline, and the nostrils are prolonged into a proboscis. Its mouth opens wide, and the jaws are rounded. There are two barbules to the chin. The buckler is very flat and bumpy, and the whole animal looks ragged and very peculiar.

The Snake-necked Tortoises of Monte Video, Buenos Ayres, and Southern Brazil have a flat but large buckler, a long neck, and pointed long head. In them the side to side movement of the neck is admirably seen, and they bring their neck under the front of the carapace by carrying it sideways. They belong to the genus Hydromedusa.

A common kind of this family, and which therefore cannot retract its head under the carapace, lives in the streams, rivers, and wet lands of the region of the Orinoco, Amazon, and other northern rivers of South America. It attains sometimes the length of thirty-two inches, and is an excellent swimmer and catcher of small fish. They are extremely numerous in some places, and assemble in crowds to sun themselves in the early part of the year, on the warm sand near the rivers. A little later they spend the day on the river banks, and in March they take to the river, and swim to the islets to lay their eggs. A few days before the laying commences, these Large Grieved Tortoises‡ line the shallow water in great rows, their heads just appearing above the water. The eggs are large, spherical, and white, and form an important part of the diet of the Indians. Large holes are made by the animals, and sets of eggs are laid by different individuals in them. Bates, when at Ega, on the Amazon, had, like the natives, to live for a considerable part of the year on this great fresh-water Turtle, as it is often called. It was the only animal food, except fish, which was to be had; and although all the arts of the native cuisine were employed, he got thoroughly tired of it. The Indians make a little place close to their homes, where they keep a stock of these "Turtles." They are caught with nets, and there is a great excitement during the hauling in; moreover, they are often harpooned in a clever manner. Bates describes the sand about a mile from the river as yielding up the newly-hatched creatures, which, after boring their way out of the sand in which the eggs had been placed, made their way in thousands, in a direct line, to their favourite element. The natives dry the eggs of this "Aiyussa" Tortoise by placing them on boards, in the smoke of a fire.

It is remarkable that this family should not only be represented in South America, but also in Africa and Australia.

* *Macrolemmys Temminckii*.

† *Platysternon megacephalum*.

‡ *Podocnemis expansa*.

One genus of it has its plastron movable in front and a flat plated head. Its species are African and Madagascan. One of them (*Sternotherus sinuatus*) was found by Dr. Andrew Smith in rivers to the north of 25° south latitude, and where the water was very deep. They were usually observed during the heat of the day lying upon rocks which projected above the surface of the water, and they were so vigilant that it was almost impossible to approach them within a moderate distance. They are long, rather high-bucklered creatures, the ovate shell being broadest behind. It is dark greenish-brown above, and the upper part of the costal plates are livid grey, whilst the plastron is pale orange, tinted with red. Its eyes are straw-yellow, and so is the head, but it is marbled with greenish-yellow.

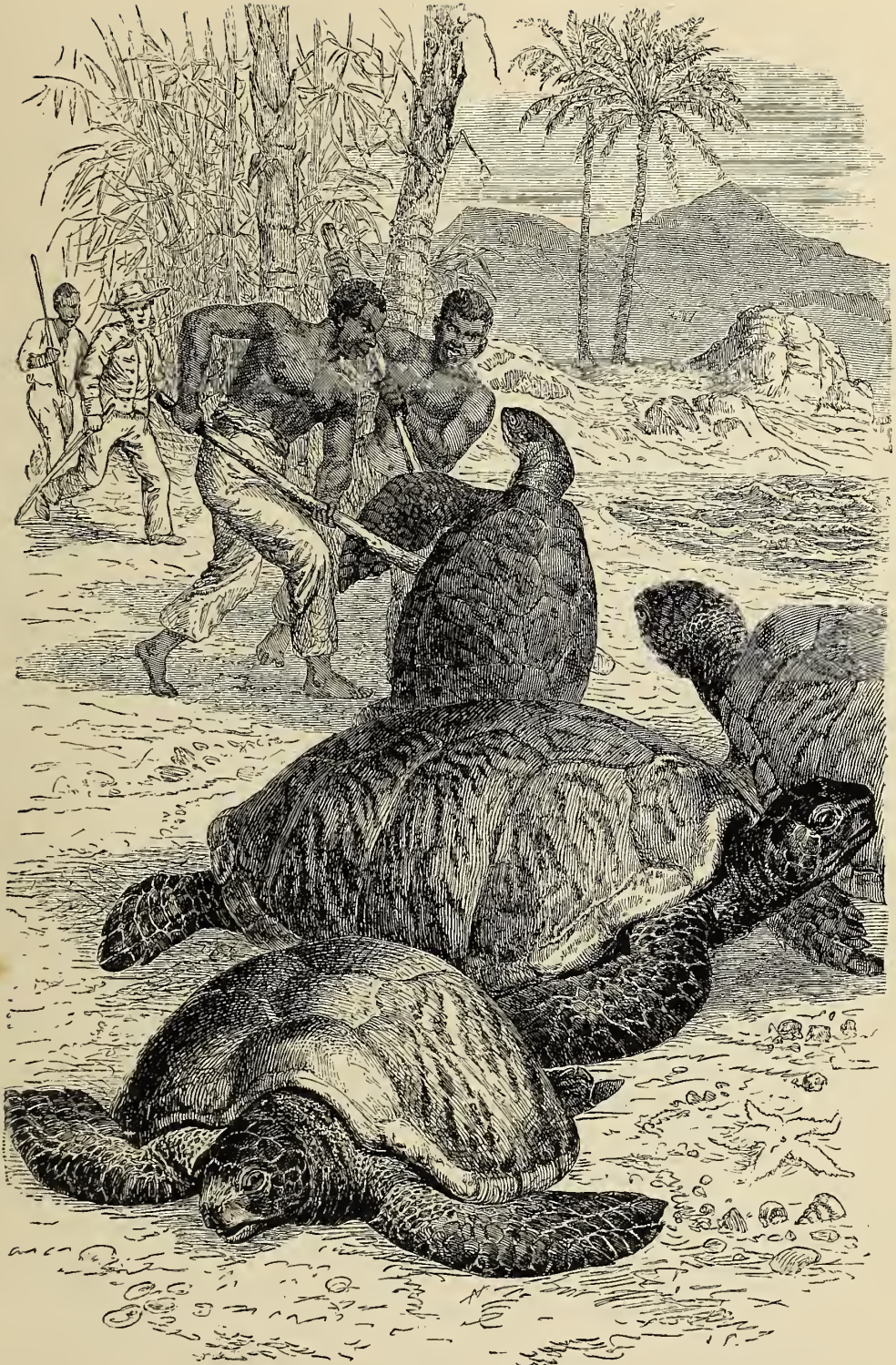
The long-necked Pelomedusa is not uncommon, according to W. T. Blanford, in the Auseba river and its tributaries in Abyssinia. But as these rivers dry up in the hot season, the creature must bury itself. It has a most offensive smell.

The Long-necked Chelodine (*Chelodina longicollis*), from the Murray region of Australia, and the Oblong Chelodine (*Chelodina oblonga*), from West Australia, belong to this family, which is thus represented in widely separated regions.

FAMILY III.—THE TRIONYCIDES.—THE MUD OR SOFT TORTOISES.

These have the carapace flat, oval, and incompletely ossified, and therefore more or less gristly and soft at the margins. The plastron, moreover, has not its pieces joined together by bone, and the covering is of skin, and not of tortoiseshell. They have a long neck, and the head is narrowed in front into a kind of snout, in which are the nostrils. These Soft Tortoises are dwellers in the rivers and streams, and even the arms of the sea, in the tropics of the Old and New World. They swim on the surface and midway down, with equal rapidity, and pursue their prey in the water, where, however, they are not without their enemies. Their colour assimilates to a certain extent with the mud, so far as the carapace is concerned, but they are usually light-coloured beneath, so that they may be brown, grey, or speckled above, and whitish, rosy, or bluish below. There is some ornamentation, in the form of numerous yellow, brown, or black lines on either side of the carapace and on the limbs in some kinds. The jaws have a skin like a lip, and the soft skin of the head has no tympanic membrane visible on it. A corresponding skin without plates on it is on the limbs, which are somewhat flattened, and more or less fin-like. Their extremities are webbed for swimming, and they have five digits on each, but only three nails. It may be noticed that the costal plates of the carapace are short, and that the marginal ossicles or plates are absent. They can draw in the neck, but not the head and limbs, within the buckler. These Soft Tortoises are carnivorous and very agile, and they catch anything that is not beyond a certain size which frequents their waters, young Crocodiles and fish especially; and, moreover, they devour the eggs of these great reptiles. When they are about to seize their prey they dart out their long head and neck with great rapidity, and bite and hold on fiercely, taking out a piece rather than loosening their hold. The eggs are membranous, with some little shell on them, and are numerous. The Soft Tortoises are found in the streams, great fresh-water lakes, and rivers of the hotter parts of Africa, Asia, and America, but on this last continent some are found in higher latitudes in the Wabash river. One common kind, the Spiny Trionyx, or *Gymnopus*, used to be a common species from New York to Pennsylvania and the Rocky Mountains, and it has been found in the Yellowstone River. It is often confounded with the *Trionyx ferox*, which appears to have a more southern home. They have a large carapace, which floats behind and has a cartilaginous circumference, and the plastron is too narrow to hide the limbs much, and there is a row of short spines along the front edge of the carapace. They retreat out of the water among rocks and the stumps of trees, plunging in again on the slightest alarm. They may be taken with a hook and line baited with a little fish, but they are apt to jerk out their heads suddenly and to seize their captor, biting him severely. Like many of the Mud Tortoises, their flesh is very nice. The females, like all others of the order, seek out spots and bury their eggs, which are numerous.

The other Soft-shelled Tortoise (*Trionyx ferox*, see p. 241) grows to a foot and more in length, and is a voracious animal, feeding on fish and reptiles, and taking the hook, but in confinement it is difficult to feed. They kill the young Alligators, and are eaten by the old ones, and reside almost constantly in the water, and come out and bask in the sun. When provoked, they dart their



CATCHING GREEN TURTLES.

long head and neck forward with great velocity, and often spring upwards, making a loud hiss. The females lay their eggs in dry sand. They inhabit the rivers flowing into the northern borders of the Gulf of Mexico, the Mississippi and its tributaries, to the foot of the Rocky Mountains, the northern lakes, and the Mohawk, but not any other Atlantic stream.

One genus of these Mud Tortoises (*Cryptopus*) has the plastron so arranged behind, as to close the opening between it and the carapace completely, by means of a kind of gristly lid on either side, the tail opening having a special one. There is a Southern Indian kind, and it is rather common on the coast of Coromandel, living in fresh water. It forms an article of diet. There is another species in the river Senegal in Africa.

The Egyptian *Trionyx* is probably the *εμύς* of Pliny, and inhabits the Nile and some other African rivers. It is sometimes three feet in length, and is a great enemy to the Crocodiles, devouring their eggs and young.

The Gangetic *Trionyx** has the bony carapace rather longer than broad, with a slight swelling in front on the vertebral line. Its surface is coarse and rugged without prominent tubercles. The species is found in the Ganges and its tributaries upwards to Nepal, and at Penang, and in rivers, and on the sea coast. It has a fierce disposition, and defends itself desperately by biting, and it utters a low, hoarse, cackling noise. The largest shell is twenty-three inches in length. Other species are from China, Japan, Cambogia, Borneo, and Singapore, and the Philippine Islands.

The genus *Cycloderma* is one of this family, and a species is called the Senegal Mud Turtle.

FAMILY IV.—THE CHELONIADES.—THE MARINE CHELONIANS.—THE TURTLES.

There are three genera in this family, two of which have much in common, but the third differs from the others considerably. All have the extremities adapted for swimming, and the carapace and plastron more or less incomplete in the bony parts. The first genus (*Chelonia*) contains the Edible Turtles, of which there may be more than one species, but the type is the Green Turtle of commerce and city feasts (*Chelonia Midas*).† They are free swimmers in the great oceans within the tropics, and sometimes they wander beyond this limit. Liking deep water—for much of their prey is found in the warm surface water, not near shallows—they beach themselves on almost all the islands where there is a sandy shore in which they can dig a hole and deposit their eggs. They are seen very generally about the warmer parts of the ocean within a few miles of land, and also hundreds of miles and farther from it, swimming or floating on the surface, and diving for a long time before reappearing. Although cumbersome on land, the largest of them, which may be seven feet in length, and weighing 800lbs. or 900lbs., swim easily and rapidly, and the smaller individuals, which may be watched in an aquarium, are most elegant in their natation, feathering their flat and curved arms with great skill when desiring to change the level of their swim. They live on the gelatinous swimming things of the ocean, the Cuttlefish tribes, the mollusca without much shell, and probably on fish. When near land they devour marine plants, such as the *Zostera*, and some are stated to wander on shore after green food. At certain times of the year shoals of them arrive at the laying stations, and usually choosing the night, crawl upon the beach, burrowing, as it were, in the sand with their flippers. The females lay a number of spherical eggs, like tennis-balls in shape, which are slightly flexible and membranous externally. Mr. Moseley, in noticing the Turtles of Ascension Island, writes‡ :—“At Ascension Island Turtles are collected, and by the side of the ‘pond’ in which they are kept there is an enclosed space of sand. The Turtles dig deep holes in it large enough to bury themselves in, and lay their eggs at the bottom. The eggs are always covered up by the Turtle, and evidently require moisture as well as an equable temperature, of no very great amount, however, for the sand in which hatching takes place does not feel warm to the hand, but rather cool. Evidently the former opinion that these eggs were incubated by the direct heat of the sun is erroneous.” The fresh egg is not quite full, so that there is a depression or crumple upon it, but shortly before hatching it becomes tense. When

* *Trionyx gangeticus* (Cuvier).

† The Green or Edible Turtle is said to be restricted to the Atlantic Ocean, but this is not the case. It is found in the Western Pacific, in the Tropics, and probably elsewhere in that great ocean. Moseley found them at the Admiralty Islands. Some naturalists make a new species (*Chelonia virgata*) of the East Indian kinds.

‡ “Notes of a Naturalist on board the *Challenger*.”

hatched, the young Turtles are lively enough, and are great gormandisers; they use their fore limbs not only in swimming, but also in tearing their food, so as to assist the mouth.

The young are hatched in from eighteen to thirty days, and make their way at once to the sea, being, however, in great danger from many enemies until they reach it, and even then they are preyed upon by Turtle-loving marine creatures. The number which do escape and live must be very great, for the extent of the shores of the Atlantic and of the islands of that ocean visited by laying Turtles is enormous.

Audubon described the life of the Turtles during their egg-laying at the Tortugas, a group of islands about eighty miles from the coast of Florida. After noticing their circumspect approach during the moonlight nights to the shore, and their crawling motion up the beach, he says that the Turtles raise the head to the full stretch of the neck, and after gazing around, form a hole in the sand with the hind flippers, using them as ladles, and casting the earth forth for several feet. This may not go on perhaps for more than nine minutes, and then the eggs are dropped in regular layers, to the number of from 150 to 200. This takes about twenty minutes, and then the sand is scraped over the eggs again, and the Turtles rush back to the water with all speed. It appears that these wanderers in the great ocean return to the same laying-ground during the breeding season.

They are caught on shore by being upset and turned on their backs, and this is usually done with stout poles, as well as with the help of the shoulder, and several men may have to join in doing this to a large individual. They rarely are able to turn back again, and are secured by the legs in the meanwhile. Sometimes nets are used to catch the smaller ones, and harpooning is also resorted to. But the prime object is to capture the Turtle alive for the markets of the great towns of the world.

These Edible Turtles have the carapace depressed, broad, and ornamented, with fifteen disc-shaped horny scales, making up the outside shell. Their head is broad, but the muzzle is short and rounded, and the upper jaw has a slight notch in front and small jagged points on the sides. The horny case of the lower jaw (or beak) is formed of three pieces, and the sides are deeply indented. The tympanum is hidden by skin, and there is a nail on the first toe of each foot.

The tortoiseshell of commerce is the product of the Hawk's-bill Turtle,* and is derived from thirteen overlapping long shields on the carapace. This Turtle does not grow to a great size, and specimens with shells more than two feet long are rare. It is known by the imbricating plates of the carapace, and by the long, compressed, and curved upper jaw, which, with the corresponding front part of the mandible, gives a beak-like look to the front part of the head. It is found in the Indian and Pacific Oceans, and it appears that they lay eggs earlier and are more prolific than the other Turtles. But they are not of value for the table. The young ones have the shell with three keels to it, and all have small horny scales imbedded in the skin of the neck. They are carnivorous, and feed on fish, mollusca, and crustacea, and Mr. Moseley states that the pretty green *Velellæ* which float on the surface are its prey in the wide ocean.

The thin imbricating plates constitute the tortoiseshell of commerce, and much of its value depends upon the manner in which, and the time at which, it is removed from the animal. If taken off when the animal is putrid the tortoiseshell becomes clouded and milky, and hence the cruel expedient is resorted to of suspending the Turtle over fire till the heat makes the shield to start from the bony part of the carapace, after which the creature is allowed to escape to the water.† In Celebes, whence the finest shell is exported to China, the animals are killed by blows on the head, and the carapace is immersed in boiling water to detach the plates.

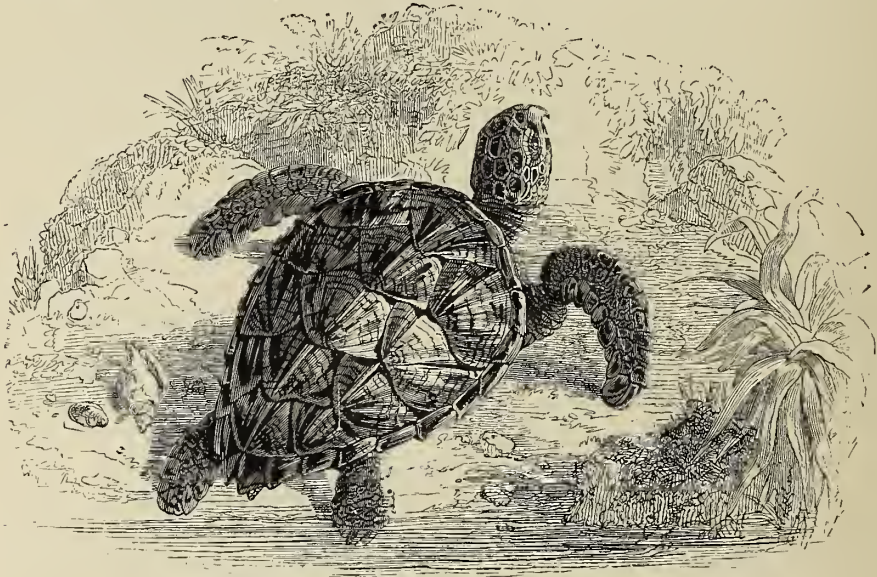
The Logger-headed Turtles‡ are probably of more than one kind. One which frequents the Atlantic and sometimes the Mediterranean Sea is of a brownish or reddish-brown colour, and the middle scales of the carapace have raised crests. Their body is broad in front, and the marginal rim is thin and broad behind. The scales are thin and flexible. There are fifteen vertebral and costal shields, and they are thin, but do not overlap.

The fore part of the jaws is beaked, but not elongated, and the head is low, broad, and flat on the top. Their fore feet are larger than those of the other Turtles. It would appear that their habits resemble those of the others, but the powerful beak enables them to crush Mollusca and Crustacea with thick shells.

* *Chelonia (Caretta) squamata*. † Tennant: "Natural History, Ceylon," p. 293. ‡ *Caozana* = *Thalassochelys olivacea*.

The Atlantic species of the Loggerhead does not appear to extend into the Indian Ocean ; and a single-clawed, long, fore-limbed kind exists there. It is the Indian Loggerhead. The shell is never much over two feet in length, and the flesh is not eaten, except by the natives of the coasts of the Bay of Bengal, of Malabar, and the Philippines.

The last genus to be noticed is that of the Leather-back Turtles, whose carapace is not covered with scales of shell, but with a dense coriaceous skin. These Turtles make a roaring noise under certain circumstances, and hence have been included in the genus *Sphargis*.* They have large fore limbs and smaller hind ones, and there are no nails. The jaws are dentilated, and the skin of the back is in longitudinal ridges. They grow to a great size, and inhabit the Atlantic and the Mediterranean, and



THE HAWK'S BILL TURTLE.

they have been cast on our coasts, having wandered to the north of their usual limits ; moreover, they are found in the temperate zones of all the great oceans. The *Sphargis*' shell has seven long projecting ridges along it, separated by grooves, and the skin is smooth in adults, but tubercular in young ones. The fore and hind extremities are well developed, and the digits are exceedingly long and form admirable paddles.

The most important points in the anatomy of the Turtles have been noticed in describing that of the Tortoise, and it is only necessary to remark on their great tenacity of life, the great independence of their muscular system, so far as the nervous centres are concerned, and the long-continued energy of their heart after its removal from the body.

THE EXTINCT CHELONIANS.

The Chelonians are a very ancient order, and their remains have been found fossilised, especially the limb bones and the carapace and plastron, these being often marked with the impressions of the tortoiseshell plates.

There are some impressions of feet which have been attributed to the Chelonians in the Trias of Scotland, but it is very doubtful whether they can be referred to them. The first definite evidence of their former existence, is in the Oolitic age. In Europe they have been discovered in the Stonesfield slate, in the lithographic slate of Ciron, in the Portland stone, and in the Purbeck strata. The Marine Turtles are represented in the Portland stone by *Chelone planiceps*, and two singularly-marked genera, *Tretosternon* and *Pleurosternon* (Owen), were discovered in the Purbeck. Probably they are allied to *Trionyx*. One of the Purbeck fossil Chelonians belonging to the genus *Pleurosternon* was believed by

* *Sphargis coriacea*, σφαργίζω, to roar loudly.

Dr. Gray to belong to a group now represented in Yutucan—*Dermatoclemys*. In the Wealden there are the remains of a Marine Turtle; and the true marine forms, *Chelone Camperi*, *C. Benstedii*, and *C. pulchriceps*, and a *Protemys* are from the Cretaceous series. The number of Turtles in the London clay is great, and the skull of *Chelone gigas* measures a foot across. One resembles a *Trionyx* in the shape of its snout, but its carapace and plastron are well ossified, and it is called *Chelone longiceps*. The Eocene of Hordwell yielded a "Soft Turtle;" this *Trionyx* is accompanied by eight fossil Emydes. The order is represented in the Miocene and Pliocene of Europe, and in the Tertiaries of America, and the gigantic sub-Himalayan *Colossochelys atlas* is accompanied by the recent *Emys tecta* (Gray). Finally, the island of Malta has yielded gigantic Tortoise remains, which are allied to the recent and extinct series of the Mascarenes and of the Galapagos Islands. Descriptions of the fossil Chelonians of the United States are to be found in the magnificent work of Cope on the "Vertebrata of the Cretaceous Formations of the West," a book given to most European naturalists by the wise generosity of the Senate, and Dr. Hayden, the head of the geological survey. The Tertiary strata have yielded fossil *Trionycides* and species of *Emys* allied to modern American kinds; and Cope discovered in the chalk of Kansas a huge Turtle with flippers considerably over fifteen feet in length, and this *Protostega* had the bony characters of a youthful modern form. It is allied to *Sphargis*. Equally interesting is the genus *Plastomenas* of Cope, which embraces the anatomical characters of *Trionyx* and *Emys*, and which is found at the top of the Cretaceous and in the Eocene. *Trionyx* has been found in the Green sand of New Jersey, and Leidy has described one from the celebrated Bad Lands of Montana. A form with a long tail like *Chelydra*, and which was as long as Temminck's Snapper, has been described by Cope, and was found with his great Turtle. As yet no Land Tortoises have been discovered fossil in America.

The European *Emys* has been found in England in a sub-fossil condition.

Günther states that the Mascarene great Tortoises *Testudo triserrata*, *T. inepta*, and two others are extinct, and that there is *Testudo Vosmaeri* extinct in the island of Rodriguez. *Testudo ephippium* of the Galapagos Archipelago is also one of these lately extinct forms.

CLASSIFICATION OF THE ORDER CHELONIA AND OF THE PRINCIPAL GENERA.

FAMILY I.—TESTUDINES	{ Genus <i>Testudo</i> .
	" <i>Pyxis</i> .
FAMILY II.—EMYDES	" <i>Kynixys</i> .
	" <i>Cistudo</i> .
	" <i>Cyclemys</i> .
SUB-FAMILY EMYDA	" <i>Emys</i> .
	" <i>Kinosternon</i> .
	" <i>Chelydra</i> .
	" <i>Platysternon</i> .
	" <i>Macrochelymus</i> .
	" <i>Chelodina</i> .
SUB-FAMILY CHELODINA	" <i>Hydromedusa</i> .
	" <i>Pelomedusa</i> .
	" <i>Sternotherus</i> .
	" <i>Podocnemis</i> .
TRANSITION SUB-FAMILY	" <i>Chelys</i> .
	" <i>Cyclanosteus</i> .
FAMILY III.—TRIONYCIDES	" <i>Trionyx</i> .
	" <i>Cycloderma</i> .
FAMILY IV.—CHELONIADES	" <i>Chelonia</i> = <i>Caretta</i> .
	" <i>Cacouana</i> = <i>Thalassochelys</i> .
	" <i>Sphargis</i> .

CLASS REPTILIA, THE REPTILES.

CHAPTER II.

ORDER CROCODILIA.—THE CROCODILES, GAVIALS, AND ALLIGATORS.

THE CROCODILE FAMILY.—Worshipped by Ancient Egyptians—The Crocodile of the Nile—Appearance—Peculiar Nature of the Tooth-growth—Arrangement for Sinking with its Prey without allowing Water to Pass into the Throat—How it Obtains Fresh Supplies of Air—How it Disposes of its Food—Remarkable Eye—"Crocodiles' Tears"—Distribution—Other African Forms—The Eggs of the Crocodile—The Baby Reptiles—The Indian Species—The Salt-water Crocodile—Description—How it Procures its Food—The Marsh Crocodile—Appearance—Worshipped by Fakirs—Ferocity of the Indian Crocodiles after their Torpidity—The Victim's only means of Rescue—Crocodile of North-east Australia—The American Kinds—*Crocodilus Acutus*—The Cuba Crocodile—THE GAVIAL FAMILY—The Gavial—Distinctive Features—Habits—Second Forms of the Family—THE ALLIGATOR FAMILY—Difference between Crocodiles and Alligators—Characters of the Alligator—The Mississippi, or Pike-headed Alligator—Habitat—Origin of its Name—Appearance—The Caimans—Characters—The Jacares—Bates's Account of the Alligators of the Amazons—Other Kinds of Jacare—FOSSIL CROCODILIA—Number in Secondary and Tertiary Ages—Antiquity of the Group—Marine Group not handed down—Characters—Terrestrial Forms of the Trias—The Theriodontia—*Hyposaurus* and *Bottosaurus*—Classification of the Order.

THE CROCODILE FAMILY.

THE Crocodile is so associated with the Nile of Egypt at the present time, that it is not surprising to find that it was well known to the ancient Egyptians, who worshipped, symbolised, and mummified this monster of their great river. It was one of the symbols of Typhon, the brother of Osiris, who was considered by the Egyptians to be the cause of every evil. One of their deities was a man with a Crocodile's head, called *Souk*. In some parts the Crocodile was eaten, whilst in others it was fed up when young with cakes and roast meat, and these, with wine, were crammed down their throats, whether they liked it or not. The name is of Greek origin, and the Egyptians gave it an appellation which sounded like *χάμψαι*. *Champsas* lasts still in modern Egyptian as *Temsa*. The large adults were sometimes caught and sent to Rome, and Augustus introduced thirty-six into an amphitheatre, where they were all killed by gladiators. Pets were made of the young Crocodiles of the Nile in the olden time, and the Egyptian priests hung rings of gold and precious stones in the protecting membrane of their ears, which they pierced for the purpose; they put bracelets on their fore-feet, and presented them, thus adorned, to the people, who looked at them with great veneration.

The Crocodile of the Nile* may be considered as the type of the order to which it belongs. The body is depressed, long, and protected on the back with solid keeled scales or scutes; the tail is longer than the body, and is compressed laterally and has crests above. The limbs are short and exceedingly powerful, and the toes are united, more or less, by a web. There are five digits on the fore limbs and four on the hinder, and nails are found on three digits fore and aft. The head is broad behind, depressed, with a muzzle, the nostrils being near the front and capable of being closed. The gape of the jaw reaches back beyond the skull, and the tongue is fleshy, not protractile, and is attached to the sides of the lower jaw within the mouth. The tympanic membrane has a valve or ear-lid.

The body of the Crocodile is carried near the ground in walking, and the hinder part of the belly drags usually, so that the limbs are set so as to permit the long bones to spread out as it were. The hind legs have a toothed crest behind, which is formed of about twelve scales. The limbs are covered with squarish and simple small scutes, and the digits also. The fore limbs are the shortest, and the two outer digits are without claws. The colour of the skin of the Nile Crocodile differs with the varieties of the species. In one the back is olive-green speckled with black, and there are two or three oblique bands of this colour on each flank. In another the upper part of the body is olive-green sprinkled with black on the head and neck, and marked with the same colour on the back and tail; two or three large oblique black bands show themselves on each flank, and the under part of the body is of a greenish-yellow colour. The nails are brown. A third has the upper part of the body sprinkled with black angular stains.

The head of a Crocodile strikes the observer more than any other part, on account of its length of jaw and the number of teeth exposed to view along the often festooned, rather than straight, jaws. The canines of the lower jaw, having a groove in the upper jaw-bone for their reception, are very

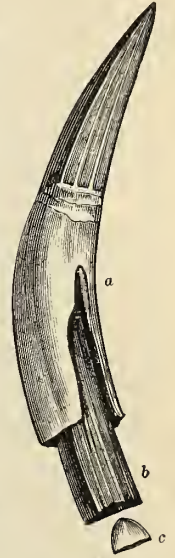
* *Crocodilus vulgaris* (Geoff.).

striking; and it will be found that the pits in the pre-maxillary bones, for the reception of the tops of the lower incisors, are sometimes perforations. The teeth are all sharp, conical, and tapering where visible, but they have a hollow cylindrical fang, which is set in a special hole or alveolus in the jaw. Crocodiles snap and tear, and thus wear or drag out their teeth, and they are constantly replaced by larger ones, for the creature's first teeth bear but a small relation in size to those of old age. Each tooth is hollowed out at the fang, so as to serve for the case or sheath of the germ of the tooth destined to replace it, and which is to be larger. The sockets for the teeth are surrounded by the bone of the pre-maxillary and maxillary bones of the upper and dentary bones of the lower jaw, and are fixed in so as to be very strong, and a fleshy cover extends around their starting-point from the jaw. As the animal grows old, the size of the teeth is not the same in all parts of the jaws.

Seizing its prey, the Crocodile, if there is any struggle, drowns it, and can manage to do so with its jaws stretched out grasping its prey, for it has a special structural arrangement by which the water is prevented from rushing down its own throat and producing suffocation. First of all, before noticing this, it must be stated that, unlike the Chelonian reptiles, the Crocodilia can breathe with the mouth open, and that the air rushes into their lungs when their movable ribs expand; for although the skin is tough and armour-plated, it is not supported by a bony expansion which restricts the movements of the ribs. They have a more or less rudimentary, but still very useful, diaphragm.

The nostrils of the Crocodilia, situated near the end of the snout, are capable of being closed at the will of the animal, and they are connected in the snout with a passage, which is limited below, not as in the Mammalia, by palate-bones alone, but also by pterygoids, and which opens far back in the throat. The roof of the mouth has a membrane on it that ends backwards in a fold which, taking away the uvula, resembles that of man in position. This upper fold rests on the back of the tongue when the mouth is closed, and the air passes above and behind it into the throat before reaching the lungs. The tongue is a large flabby structure, incapable of protrusion, and has a hyoid bone at its broad hinder part in the throat, and on it and the tongue is a lower flap of membrane reaching across the throat, and being parallel at its free edge with the upper fold. When the Crocodile drags a struggling animal into the water in its jaw-grip, it shuts its nostrils, sinks down, and closes the back of its throat by muscular action, which brings the upper and lower membrane folds together. No water can then pass into the throat. After a while the Crocodile just raises the tip of its snout above water, opens the valves of its nostrils and takes in air, which passes along the passage above the palate, behind the folds of skin into the throat, and thence into the lungs. It tears its prey, if soft; should it not be able to bolt it, it hides it away until decomposition softens the tissues and permits them to be swallowed. The food passes along a narrow long gullet and œsophagus to a single globular stomach, the mucous membrane of the passage being folded and villous, but that of the stomach is very thin. The opening in the stomach for the intestine is close to that for the œsophagus, and there is a small pyloric *cul-de-sac* separated off from the main cavity, through which food must pass into the intestine. The stomach has the mucous membrane thin, and it is folded and placed in serpentine ridges: the cellular coat outside it is thick, and the more external muscular tunic, made up of fibres radiating from the centre to the circumference, issuing from a kind of disc of membrane, is very strong. This stomach is not without its resemblance to the gizzard of a Heron. The food gets crushed and digested in part there, and passes into a much-folded small intestine, with a peculiar glandular layer, and then into a large gut with internal projections on its membrane.

The organs of special sense are elaborate in the Crocodilia. Thus the eye may have a vertical or a horizontal pupil, according to the nocturnal or crepuscular habits of the species, and all have the ciliary processes fully and beautifully developed. A peculiar vascular membrane, covered with pigment, projects into the vitreous humour of the globe, and then is connected with the capsule of the lens. The upper and lower eyelids are well developed. There is a transparent nictitating membrane moved by a special muscular apparatus, and there is a gland especially destined to facilitate the move-



GROWTH OF TOOTH OF CROCODILE.

(a) Tooth fully developed. (b) Tooth nearly developed to succeed a. (c) germ of third Tooth which in due time will succeed and displace b.

ments of this eye-protector, and its secretion escapes through a duct opening upon its inner surface. "Crocodiles' tears" are household words, and the reptiles have a large lachrymal gland to each eye. The ear has an outside lid or valve, which can be shut down when the Crocodile dives, and it protects the tympanic membrane, which is otherwise exposed.

The heart has two auricles, and the ventricle is more or less divided into two by a septum, or by a cellular arrangement which produces a certain amount of separation of the purified and impure blood.*

The Nile Crocodile has a wide distribution in Africa, from Egypt to Senegal, and south to near the Cape, and in Central Africa. Specimens are in the British Museum fifteen feet in length, and it will be noticed that the feet are webbed, that the nasal bones form a projection which separates the hinder edges of the nostril, and that the forehead is flat.

There are two other Crocodiles in Africa, and they are from the west coast. One is very singular-looking, from its long thin snout,† but which is truly Crocodilian, from the lower canines being seen to bite in a groove in the upper jaw.

This long, slender-snouted Crocodile grows to a large size, and lives in West and Central Africa, in Gaboon, and in the neighbourhood of Lagos. It has plain orbits, and the nasal bones do not reach the nostril.

The Black African Crocodile‡ is from Western Africa, Senegal, Gaboon, and the Ogobai River, and is very unlike its fellow just mentioned, having a broad, short face (like an Alligator), with two bony plates on the eyelids, a turn-up nose; and the nostril is divided in half by the nasal bones, which form a small part of it. The line of the teeth of the upper jaw is very wavy, and they are rather blunt-topped. Its habits are probably those of the Common Crocodile.

The Madagascar Crocodile has the snout longer, slenderer, and with straighter sides than the Nilotic Crocodiles.

The eggs of the Crocodiles are small, not larger than those of a Goose, and the little ones come forth very like the parents in shape, with large-looking eyes, a great gape, and a fine set of sharp teeth. Herodotus noticed the wonderful difference in size between the egg and its little tenant at birth and that of the full-grown reptile, and it is indeed very remarkable.

There are two well-known species of the genus in India, one of which is the Salt-water Crocodile,|| which lives in the estuaries of the great rivers and makes its way to sea for a while, and the other is the River and Marsh Crocodile, which is found well in the interior, and even up in the outer Himalayan valleys in not very warm water.

The first is a large reptile, with many of the characters of a Nilotic Crocodile, but it differs in the arrangement of the scales behind the head. It has no nuchal scales, and the dorsal ones are oval and long, instead of being as broad as long. It grows to a length of fifteen feet commonly, and it is said to reach double that size. One skull is thirty-one inches long, and, in common with all of its kind, has a long ridge on the face.

A considerable part of the food of this Crocodile is fish, which fall an easy prey, especially to the smaller and youthful reptiles. The old ones, requiring much food, attack every large animal which accidentally approaches them, and in overpowering it the whole of their powers are called into play. Seizing the victim between their capacious jaws, and fastening their long-pointed conical teeth into its flesh, they drag it below water and drown it. As they cannot swallow their large prey they mangle it, tearing off pieces by sudden strong jerks. This is performed by lateral motions of the head and front part of the body.

When the animal, in one of its favourite positions, floats with just the upper part of the head and back out of water, it can still breathe, hear, and see; and when it dives, the nostrils are closed by valves, a transparent membrana nictitans is drawn over the eye, and the ear, a horizontal slit, is shut up by a movable projecting flap of the skin.

* The vertebræ have their bodies hollow in front, and are procœlous, and swollen behind, so as to admit of much motion. There are so-called uncinæ processes to the ribs, and in the neck they form a remarkable lateral protection of a strengthening kind.

† *Crocodilus cataphractus* (Cuvier) = *Mecistops cataphractus* (Gray).

‡ *Crocodilus niger* (Latr.) = *C. palpebrosus* (Cuvier) = *Osteolemus tetraspes* (Cope) = *Crocodilus frontosus* (Murray).

|| *Crocodilus porosus* (Schn.) = *Crocodilus biporcatus* (Cuvier).



The other Crocodile, which may attain the same size as the last, but is usually found smaller, is the Marsh Crocodile,* which has also been called *Crocodilus bombifrons*. It is found in the Ganges, and at Malabar, Madras, Ceylon, and in the Indus. Its snout is covered with numerous small irregular prominences, and the space between the eyes is deeply concave.

It is often called Alligator by European residents, but it is a true Crocodile. It is a ferocious reptile, and is worshipped and kept by some religionists. Thus, about eight miles north of Kárachi,



CROCODILUS ACUTUS.

in Sind, there are some hot springs which swarm with these "Muggars." They are tame, and know their Fakir friends, who watch and feed them.

A species of the genus inhabits Siam and Cambojia, and is called the Siamese Muggar,† and has a close resemblance to the Marsh Crocodile of India, the face being much larger, however, and not so bumpy, but there is a small knot in front of the orbit. Another is an inhabitant of the rivers and estuaries of Southern India, and has been called the Pondicherry Crocodile.‡

* *Crocodilus palustris* (Less.).

† *Crocodilus Siamensis* (Schu.).

‡ *Crocodilus Pondicherrianus* (Gray).

The Indian Crocodiles inhabit not only rivers and estuaries, but the sea-coasts, and they may be seen floating two or three miles from shore in calm weather. Those inhabiting small inland waters which are dried up in the rainless season bury themselves and remain in a state of torpor until the rains come, when they emerge and are dangerous and hungry. They then will attack man, who has but one means of saving his life or limb, namely, to force his fingers into the eyes of the beast, which immediately lets go its victim, a practice equally known to the Indian of South America, in relation to Alligators, to the negro of Africa, and to the Hindoo. It has been said that a single Crocodile will often appropriate to himself a limited district, which, if it happens to be in the vicinity of a village, will soon be perceived in the loss of the grazing cattle.

North-eastern Australia has yielded a Crocodile of very unusual shape of head, and it was discovered by Mr. Johnston, of Cardwell, Rockingham Bay, Queensland. Its head and snout are very long, slender, and conical; the forehead is flat between the eyes, and there is a slight convex narrow ridge in front to the middle of the beak. It is called *Crocodilus Johnstoni* (Gray).

There are two kinds of Crocodile in America; one is well known, from its very elongate head* and the constriction of the muzzle just behind the large pre-maxillary bones, and from its habits, which are notably interesting to geologists. It has a great range, being found in many of the rivers of the north-east of South America, in Central America, and in some of the West Indian Islands. It has been found in Ecuador, New Granada, Venezuela, Yucatan, Guatemala, Southern Mexico, Cuba, San Domingo, Jamaica, and West Coast of America. A free swimmer, it takes to the sea, and in this, and to a certain extent in the shape of its snout, resembles some of the Teleosaurs of old which geologists classify as Marine Crocodiles. It preys on large and small animals, and the Jaguar and Tapir fall victims to it, as well as fish. The face is slender, and the forehead is swollen and convex; the nasal-bones recede and the muzzle is conical, oblong, and the nostril is not separated by a ridge. There are two or four small nuchal plates. The legs are fringed and the toes are webbed. Mr. Gray describes an Orinoco Crocodile, which is probably a variety of this one.

The other American kind is the Cuba Crocodile, or the Aquez palin,† and it inhabits Cuba, Mexico, part of South America, and Yucatan. It has an oblong face, with a very convex forehead, a ridge in front of each orbit converging in front and forming a lozenge-shaped space. There are two or four nuchal plates, and the cervical disc is rhombic and of six large plates. The toes are short in this kind, and the web is very small.

THE GAVIAL FAMILY.

The Gavial,‡ or Nakoo, is a large reptile, with very much of the shape of the Crocodile, but with an exceedingly long and slender face, and the snout with the end swollen, and a great set of teeth. The teeth are tolerably equal, and the first tooth of the lower jaw, as well as the fourth, bite into grooves in the upper; the side teeth are oblique, and altogether there may be twenty-eight above and twenty-six below. The nostrils are large, and the nasal bone does not form part of them. The orbits look very prominent, because their front margin is much raised, and the back of the head looks massive, because the cervical and dorsal plates form a continuous shield, and are not separated as in the Nile Crocodile.

It is a lover of the large rivers, of the Ganges especially, and occurs in Nepal, and also in the Malabar rivers, but it has not the range of the Crocodile, which can stand very chilly water. The Gavial is much more aquatic than the Crocodile, and is rarely seen at all, and very rarely indeed out of water. It is a capital swimmer, and its long snout enables it to breathe without showing its body. Fish are its principal prey, and it grows to the length of twenty feet.

The second genus of the Gavial family is an inhabitant of the Island of Borneo and of some of the neighbouring islands, and differs from the Gavial in having a more conical beak, thick at the back; and the side teeth are erect and are received into pits between the upper ones. These are less numerous than in the Gavial of the Ganges, and the nostrils are not expanded, neither is there a ridge to the orbit.||

* *Crocodilus acutus* (Geoff.)=*Molinia americana* (Gray)=Orinoco crocodile.

† *Crocodilus rhombifer* (Cuvier); *Palinia rhombifer* (Gray).

‡ *Gavialis gangeticus*.

|| *Tomistoma Schlegelii*.



THE GANGES GAVIAL.

THE ALLIGATOR FAMILY.

The distinctions between Crocodiles and Alligators only require a little more than ordinary observation for their comprehension.

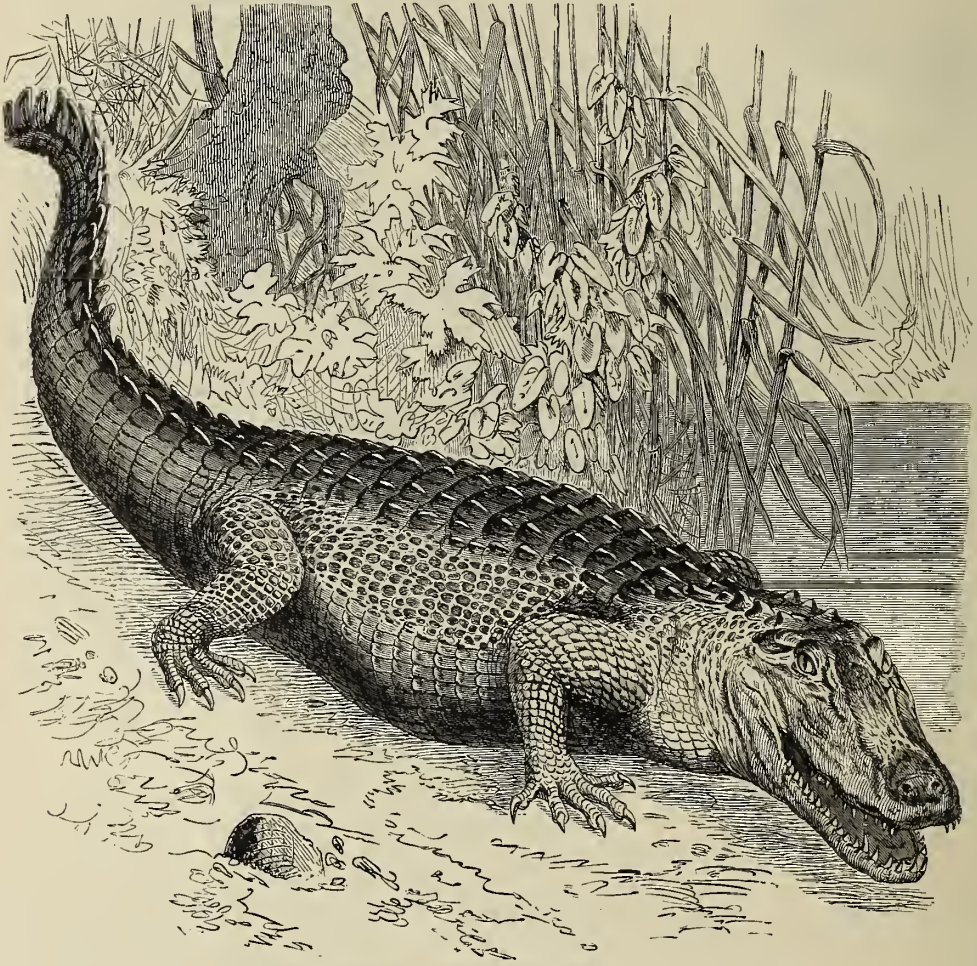
The head of the Alligator is short and broad; that of the Crocodile is longer. The teeth are very unequal in the Alligator, and the large lower canine, or the fourth from the front, enters a hole in the upper jaw, and is more or less hidden when the mouth is closed. The teeth of the Crocodile are less unequal, and the large canine is visible when the mouth is closed, as it fits in a groove on the side of the upper jaw. The hind legs and feet of the Alligators are round, and neither fringed nor ragged, and the toes are not webbed further than the middle, these structures, as has been shown already, being differently developed in the Crocodiles.

The scales of the neck and body are arranged differently in the two reptiles, and in some Alligators they form a continuous armour. With these exceptions the external aspect of the animals is similar; and there is not much difference in their habits, the Alligators rarely, if ever, going down to the sea, while the Crocodiles do so occasionally.

The Alligators form a family, and probably but one genus; but Dr. Gray and others have formed three genera—Alligator, Jacare, and Caiman—and there are several species.

Of the genus Alligator there is the species called the Mississippi Alligator, or the Pike-headed

Alligator.* This formidable reptile formerly inhabited the fresh waters of the Carolinas, the Mississippi, higher than the Red River, and the swamps of Florida, Georgia, and Louisiana, but its present roaming ground is more restricted. Growing to a length of fourteen or fifteen feet, the head is one-seventh of the length, and half as broad at the articulation of the jaws as it is long. The snout is flattened on the upper surface, and it is rounded broadly in front and straight at the sides. The shape of the fore part of the head is so Pike-like that Cuvier gave the Alligator the name of *lucius*—a Pike.



THE MISSISSIPPI, OR PIKE-HEADED ALLIGATOR.

The internal rim of the orbits is large and projects, and the nostrils are separated by a long knob. The skull has two shallow oblique oval pits, with two small holes. The colour is a deep greenish-brown above and a light yellow below, and the sides are more or less striped. They have a bright observant eye, and hiss from the back of the throat, and snap their jaws together, when angry. It is said that men and quadrupeds of some size fall a prey to it whilst bathing, drinking, or crossing rivers, but usually they prey by night, and in companies. Fish are their principal food. It is said that the female digs a hole in the sand, and deposits her eggs in layers separated from one another by layers of leaves and dry grass, and that but one laying occurs in a year. The Alligators hibernate and bury themselves in the mud as soon as cool or cold weather sets in, and come out with the returning heat. The eyelids are smooth and fleshy in this Alligator.

* *Alligator lucius*.

The Caimans are of two kinds: one is the Rough-backed Caiman,* from Tropical America, and the other the Banded Caiman, from the same region.† They have, unlike the true Alligators, the bony ventral and dorsal scales articulated together. Their smooth eyelids have an internal bony plate, and the cervical scales form an elongated shield. Their head is high, flat at the sides, and angular above. On the side of the neck and body the scales are keeled, but those beneath the body are smooth. In the first species the cervical scales are in five pairs, and the nuchal scales are in a single cross series, whilst in the second the nuchal scales are in two cross series, and the cervical are in three pairs. There are no ridges between the orbits.

The other group, the Jacares, is numerous in species, and they have much in common with the Caimans as regards their armour and eyelid bone. They all have their orbits united by a bony cross ridge, and the eyelids are striated or rugose. They have the head moderately high, and the cervical scales are in pairs forming a bony shield.

One kind, called the Black Jacare,‡ from its black back varied with yellow, attains the length of thirteen feet and more, and inhabits the Amazons near Pera and also Guiana. It has a long head, and the nuchal scales are small and compressed.

Bates, that thoroughly trustworthy naturalist and geographer, who spent so much time in the investigation of the Natural History of the Amazons and its neighbourhood, gives some personal observations on the Alligators of the river. When at Ega, on the Upper Amazons, he wrote:—"Alligators were rather troublesome in the dry season. During these months there was always one or two lying in wait near the bathing-place for anything that might turn up at the edge of the water—dog, sheep, pig, child, or drunken Indian. While this visitor was about, every one took extra care whilst bathing. I used to imitate the natives in not advancing far from the bank, and in keeping my eye fixed on that of the monster, which stares with a disgusting leer along the surface of the water, the body being submerged to the level of the eyes, the top of the head, with part of the dorsal crest, being the only portions visible. When a little motion was perceived in the water behind the reptile's tail, bathers were obliged to beat a quick retreat. I was never threatened myself, but I often saw the crowds of women and children scared whilst bathing, by the beast making a movement towards them. A general scamper to the shore and peals of laughter were always the result in these cases. The men can always destroy these Alligators when they like to take the trouble to set out with montarias and harpoons for the purpose, but they never do it unless one of the monsters, bolder than usual, puts some one's life in danger. This arouses them, and they track the enemy with the greatest pertinacity. When half killed they drag it ashore and despatch it amid loud execrations. Another, however, is sure to appear some days or weeks afterwards and take the vacant place or the station." But under some circumstances the Jacare nigra, the Jacaré-usassú of the Amazonian Indians, is little feared. Thus, when netting the "Turtles" (page 255), which form the staple meat food of the inhabitants, an Alligator was found included, and although the men had jumped into the water to drag and catch the Chelonians, they cared little for a good-sized Alligator, whose jaws, more than a foot long, could have snapped one of their legs in twain. Bates writes:—"No one was alarmed, the only fear expressed being that the imprisoned beast would tear the net. First one shouted, 'I have touched his head!' then another, 'He has scratched my leg!' One of the men, a lanky Miranha, was thrown off his balance, and then there was no end to the laughter and shouting. At last a youth of about fourteen years of age, on my calling to him from the bank to do so, seized the reptile by the tail and held him tightly until, a little resistance being overcome, he was able to bring it ashore. The net was opened, and the boy slowly dragged the dangerous but cowardly beast to land, through muddy water, a distance of about a hundred yards. Meantime I had cut a strong pole from a tree, and as soon as the Alligator was drawn to solid ground, gave him a smart rap with it on the crown of his head, which killed him instantly." The same traveller at one time, when out on an expedition and the heat was very great, found that no one could bathe without being advanced upon by one or other of these hungry monsters. "There was much offal cast into the river, and this, of course, attracted them to the place. One day I amused myself by taking a basketful of fragments of meat beyond the line of ranchos, and drawing the Alligators towards me by feeding them. They behaved pretty much as dogs do when fed, catching the bones I threw them in their

* *Alligator trigonatus*=*Caiman trigonatus* (Gray).

† *Caiman palpebrosus* (Gray).

‡ *Jacare nigra* (Gray)=*Alligator sclerops* (Cuvier).

huge jaws, and coming nearer and showing increased eagerness after each morsel. The enormous gape of their mouths, with the blood-red lining and long fringes of teeth, and the uncouth shape of their bodies, made a picture of unsurpassable ugliness. I once or twice fired a heavy charge of shot at them, aiming at the vulnerable part of their bodies, which is a small space situated behind the eyes, but this had no other effect than to make them give a hoarse grunt and shake themselves. They immediately afterwards turned to receive another bone which I threw them."

A small Alligator, not more than two feet in length, the Jacaré curúa, is found in shallow creeks on the Lower Amazons. The Indians said one that was brought to Bates "was a mai d'ovos," or mother of eggs, as they had pillaged the nest which they had found near the edge of the water. The eggs were rather longer than a hen's and regularly oval in shape, presenting a rough, hard surface of shell. This kind was cooked and eaten.

Other Jacares have the head sharp, and the back is olive colour banded with brown, and one of the group, the Dog-headed Jacaré,* has the face and snout marked with dark spots at the sides, and the skull is broad and shallow. It inhabits the Brazils about Pernambuco, and also Surinam. The second kind is the Brazilian Jacaré. The Long-shielded Jacaré of Tropical America has an olive colour, and the jaws are spotted.† It has a long head, no ridges in front of the orbit of any importance, and the cervical disc is oblong, and it much resembles the Eyed Jacaré‡ from the lake of Santa Cruz de la Sierra. The Argentine Republic, Brazil, and Surinam, have a narrow-faced, high-nosed Jacaré, whose jaws are yellow in colour, or spotted, the back being yellow banded with brown. It is called the Dotted-jawed Jacaré.§ And, finally, there is a kind from Demerara called the Rough-necked Jacaré,|| which has the scales on the side of the neck rough, spiny, and pale yellow, the back and tail being brown and cross-barred. The cheeks and sides of the lower jaw are yellow and not spotted.

FOSSIL CROCODYLIA.

So numerous were the Crocodilia in the Secondary and Tertiary ages that a considerable volume might be written upon their characteristics and localities; therefore a short summary of their peculiarities can only be given here. In the endeavour to comprehend the structures of the Crocodiles of old, the nature of the vertebræ and of the roof of the mouth of the Niliotic Crocodile should be considered. The modern Crocodilia have the body of the vertebræ in front of the sacrum concave or procelous in front, and the hard palate is formed by the union of the palate bones and of the pterygoid bones behind them, so that the internal air passage from the outer nostril is far back in the long mouth. This group of Crocodilia, embracing the three modern families of Crocodile, Gavial, and Alligator, has a great antiquity, for Crocodilia with the above anatomical characters, existed in the age of the Green Sand of America and of the Upper Cretaceous of Europe. *Thoracosaurus* (Leidy), *Holops* (Cope), from America, and *Gavialis macrorhynchus*, of the European chalk, are to be classified with this modern group termed by Owen "Procelia." The Crocodilia of the Tertiary age found in the London clay, the Plastic clay of Meudon, and the Calcaire Grossier of Castelnaudry, and in the Eocene deposits of Bracklesham were large, and all the three families were represented in those times: that is to say, such forms as *Crocodylus toliapicus*, *Crocodylus Hantoniensis*, and *Crocodylus Dixoni*, are indications that Crocodiles, Alligators, and Gavials lived then in Western Europe. In the later Tertiary deposits the group is represented, and in the Sewalik hills in the Himalayas there is a thick-toothed Crocodile of extinct species, and one which resembles the Muggar.

The great series of strata belonging to the secondary rocks, from the lower Lias to the upper Chalk inclusive, contain evidences of the former existence of another group of Crocodilia. The genera which form it probably led marine and along-shore lives, and the more terrestrial kinds, such as would now be the true Crocodiles and some Alligators, have not been handed down by fossil remains. Gavial-like kinds, which moved out to sea like the Crocodile of San Domingo, but which came rarely to land, existed as the genera *Steneosaurus* and *Teleosaurus*. In these Crocodilia, the bodies of the vertebræ were concave before and behind, or amphicæalous, and the pterygoid bones did not come into the hard palate, the posterior nostrils being behind the palatine bones only, and there were two longitudinal series of

* *Jacare latirostris* (Gray) = *Alligator cynocephalus* (Dum., et Bib.).

† *Jacare longiscutata*.

‡ *Jacare ocellata* (Gray).

§ *Jacare punctulata* (Gray) = *Jacare sclerops* (Gray).

|| *Jacare hirticollis* (Gray).

dorsal scutes instead of more, as in the Proœlia. This group of Amphicœlia became extinct during the early days of the Proœlia.

Mr. Hulke, F.R.S., has shown that in the Wealden and Purbeck deposits there is a fossil Crocodile intermediate in its characters of skull between those of the Lias and Tertiary times.

The next group preceded these in time, and lived and died out in the days of the vast continental surfaces of the Trias. Instead of being perfectly aquatic forms, these Crocodiles were very terrestrial, and the conformation of their nostrils and hard palate leads to the belief that they had no necessity to drown their prey, and that they had not the peculiar method of life of the more modern groups. The bodies of the vertebræ of these early secondary kinds were amphicœlous, but neither the palatine nor the pterygoid bones were produced into plates, so as to form a hard palate and place the internal nostrils far back in the mouth. Hence the outside nostrils communicated with the mouth in the front part of the palate. They had two long series of keeled, joined, dorsal scutes, and in some there was a ventral armour. The genus *Stagonolepis* is from Elgin, in Scotland; and *Parasuchus* from India, and *Belodon* from Germany and North America. They have been called by Huxley "*Parasuchia*."

Owen, of whose classification of the fossil Crocodiles the above is a modification, has described some little Crocodilia which he considers were sufficiently large to kill and devour the small Marsupial Mammals of the age of the Purbeck deposits (Upper Oolite).

Associated with the fossil Crocodilia is an order in which large and small reptiles with bi-concave vertebræ have a dentition of teeth in sockets, which somewhat foreshadows the carnivorous Mammalia. These Theriodontia of Professor Owen probably commenced in the Permian age, and lived in the Oural region in Asia, and in North America, South Africa, and England, during one or more of the geological ages down to the end of the Oolite period.

Cope notices two species of Crocodilia from the Cretaceous formations west of the Mississippi; one eight or ten feet in length is *Hyposaurus*, which had sub-biconcave vertebræ and a long sub-cylindrical snout; and the other was a short-headed species like the *Alligator lucius*. The New Jersey Cretaceous has also yielded Crocodilia of this genus—*Bottosaurus* as well as *Hyposaurus*, and there is a long-nosed Gavial from the same strata named *Holops* by Cope, and a second which is a Proœlian Crocodilian, small in size, but also a Gavial.

CLASSIFICATION OF THE ORDER CROCODYLIA.

FAMILY—CROCODYLIDÆ	Genus <i>Crocodylus</i> .
GAVIALIDÆ	{ „ <i>Gavialis</i> .
	{ „ <i>Tomistoma</i> .
	{ „ <i>Alligator</i> .
ALLIGATORIDÆ	{ „ <i>Caiman</i> .
	{ „ <i>Jacare</i> .

CLASS REPTILIA, THE REPTILES.

CHAPTER III.

ORDER SAURIA, OR LACERTILIA.—THE LIZARDS.

THE LIZARDS—Characters of the Reptiles of the Order—**THE FISSILINGUES**—**THE SAND LIZARD**—Prof. Bell's Description—**THE COMMON LIZARD**—Habits—Young Produced Alive—Characters of the Lizard—Distinctions between Crocodile, Lizard, and Snake, illustrated by Comparison of the Skull (foot note)—Other Species of Lacerta—Peculiarity of the Tail of many Lizards—Teeth of Saurians—A "Pleurodont" Jaw—An "Acrodont" Jaw—**THE AMEIVIDÆ**—Characters—**THE COMMON TEGUEXIN**—Habits—**THE COMMON AMEIVA**—**THE WATER LIZARDS**—Description—Why called Monitors—**THE NILE MONITOR**—**THE MONITOR, OR SAND VARANUS**—Other Kinds of Varanus—The Common Indian Water Lizard—The Ocellated Water Lizard—The Heloderma—**THE CRASSILINGUES**—Characters—**THE IGUANAS**—**THE GREEN IGUANA**—Description—Habits—Character of the Vertebrae—Dentition Pleurodont—**THE BASILISK**—Appearance—**THE AMBYLRHYNCHUS CRISTATUS**—Darwin's Account of this Sea Lizard—The Terrestrial Species of this Genus—**FLYING LIZARDS**—Characters—Their Apparatus for Locomotion—Habits—Beauty of their Colouring—**THE FRILLED LIZARD**—Description—The Frill—**THE TERRESTRIAL AGAMIDÆ OF THE OLD WORLD AND AUSTRALIA**—The Genus *Uromastix*—The Dabb, or Dhobb—The Thorn-devil, or Horrible Moloch—The Genus *Stellio*—The Toad Lizards—**THE GECKO FAMILY**—Appearance—Habits—Their Toes and Fingers—Characters—Colouring—Eyes—Tongue—Origin of their Name—Pleurodont Teeth—The Various Species—The Flying Gecko—**RHYNCHOCEPHALA, THE BEAKED LIZARD**—**THE TUATÉRA, OR HATTERIA, OR THE SPHENODON LIZARD**—Günther's Description of its Anatomy—**THE VERMILINGUES, THE CHAMÆLEONS**—Appearance—Curious Tongue—Remarkable Lungs—Distribution—Colouring—The Genus *Rhampholeon*—The South African Kind—Changing of the Colour of the Chamæleon's Skin—**THE AMPHISBÆNOIDA**—The White *Amphisbæna*—**THE BREVILINGUES**—Characters—**SCINCOIDÆ**—**THE COMMON SKINK**—Habits—The Stump-tailed Lizard—**THE BLIND-WORM, OR SLOW-WORM**—Description—**THE JAVELIN SNAKE**—**THE ZONURIDÆ**—Character—The Gigantic *Cordylus*—The European *Pseudopus*—American Glass Snake—Classification of the Order Sauria.

The reptiles included in this order are very numerous, and present much diversity of shape and habits. Some resemble the Crocodiles, but have neither their bony-plate armour nor their socket-implanted teeth. Others are after the type of the Common Lizard, and the rest are more or less limbless, and in some the shape of the Serpent is recognised. But all have a more or less perfect shoulder-girdle and sternum, and usually, but not invariably, four limbs are present. Their throat is not extensible, and the jaws cannot separate as in the Serpents. Many have glands with pore-like openings on the thighs.

There are many groups of these reptiles, which are subdivided into families. The long-bodied, short-limbed, scaly, long-tailed Lizards of this country may be considered first of all, as their shape is familiar to everybody. They belong to **THE SUB-ORDER FISSILINGUES, THE SPLIT-TONGUED LIZARDS**, characterised by having a long, slender, protractile, forked tongue, the teeth pleurodont* in arrangement, a free tympanic membrane, and procœlous vertebrae.

THE SAND LIZARD.†—GENUS LACERTA.

This English species of Lizard received especial attention from Professor Bell, who writes, in his "History of British Reptiles" :—"This beautiful species is found in the neighbourhood of Poole, in Dorsetshire, in somewhat different situations. Its general abode is on sandy heaths, where it is frequently seen crossing the small by-paths with considerable swiftmess, although it is certainly less rapid in its movements than the next and more common species. But it is occasionally seen on the sunny sides of green banks basking in the sun's rays, and retreating rapidly on the approach of any intruder." It is occasionally seen near wet ground. It is a very timid and wild little thing, and Bell states that it will bite if handled, and that it pines and dies in captivity. It is a northern kind, rarely occurring so far south as Italy, but it is common in the northern parts of France and the central parts of Europe, extending as far north as Denmark and Sweden. In its form, this kind is thick and rounded in the body, the limbs are strong and short, and the head is obtuse.

The third and fourth toes of the foot are of equal length. On the head, which is plated, the eyelids have a series of very minute scales. The scales of the upper part of the body are round or polygonal, and slightly keeled. The abdominal plates are in six rows, the middle series being narrower than the adjoining ones. The throat has a distinct collar of scales.

The femoral pores vary from eight to eighteen on each side. The tail is covered with numerous distinct whorls of scales, fifty to eighty in number, and the total length of the Lizard is seven inches two lines, that of the tail being four inches. It has teeth on the palate.

* See page 275.

† *Lacerta agilis* (Linn.).

It varies much in its colour and markings. The most common tint of the upper parts is a sandy-brown, with obscure longitudinal bands of a darker brown, and a lateral set of black round spots, each marked with a yellowish-white dot or line in the centre. There is often, according to Bell, more or less of green on the sides. Some are of a rich brown colour, others of a green hue of a dullish tint, and it is this which has led to the belief that a species called the Green Lizard occurs in England. The female lays her eggs, to the number of twelve or fourteen, in hollows in the sand, which she excavates for the purpose, and having covered them carefully with sand, she leaves them to be hatched by solar heat.



THE SAND LIZARD.

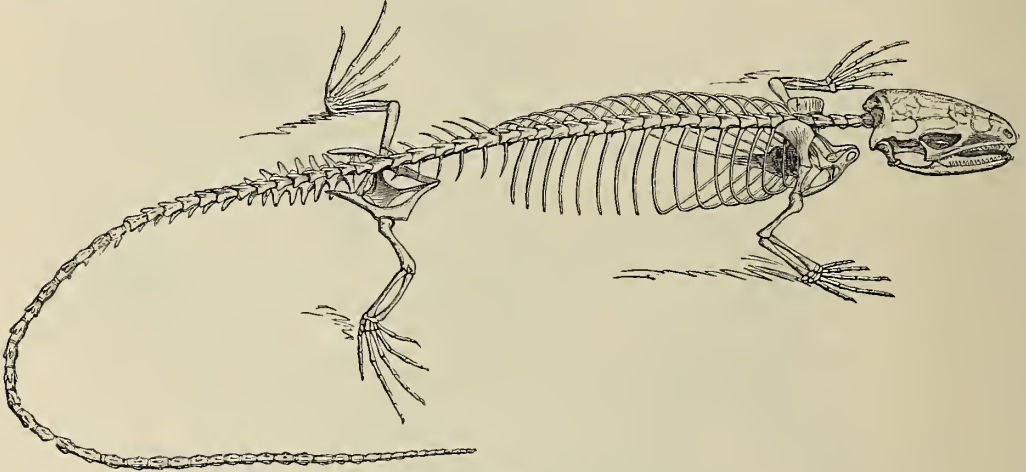
SUB-GENUS ZOOTOCA.—THE COMMON OR VIVIPAROUS LIZARD.*

This Lizard has the temples covered with adpressed scales, and the scales of the back are long and hexagonal, but there are no teeth on the palate. Hence it differs from the Sand Lizard, and has been placed in a sub-genus *Zootoca*, and as it brings forth its young alive and not within the egg, it is termed the Viviparous Lizard. It is an agile and pretty Lizard, frequenting many heaths and banks in England and even in Scotland. It is one of the few reptiles which are found in Ireland. It is confined to our latitude on the Continent. Bell says:—"It comes out of its hiding-place during the warm part of the day, from the early spring till autumn has far advanced, basking in the sun, and turning its head with a sudden motion the instant that an insect comes within its view, and darting like lightning upon its prey, it seizes it with its little sharp teeth, and speedily swallows it.

* *Lacerta (Zootoca), vivipara*. See note on next page.

Thus, it will often take a great number of the smaller insects, preferring those of the two-winged order, though it will not refuse many of the beetles and Orthoptera, if they are not too large."

The female retains the eggs until the young are ready to leave them, and they are produced alive. The covering of the egg is very thin and membranous. As the young are sometimes found with the mother, it is possible that she has some maternal instincts. The young are fully formed when born, and are capable of running about and of taking care of themselves. This little Lizard is from five inches and a half to six inches and a half in length, of which the head occupies half an inch, and its colour and markings vary much. The general ground colour of the upper parts is a greenish-brown, with a



SKELETON OF THE COMMON LIZARD.

dark brown line down the middle of the back, which is often somewhat interrupted. A broad stripe or belt extends parallel with this on each side, commencing behind the eyes, and extending to a greater or less length down the tail; between this and the former are often one or more rows of black dots, and similar ones may occur on the lines. The under side of the body and base of the tail, in the male, are bright orange, spotted with black; in the female these parts, as well as the tail, are pale greyish-green, without spots.

The other species of *Lacerta*, which may be seen frequently on the Continent of Europe, are the Green * and the Ocellate † Lizards, and the lively little Wall Lizard. ‡

There are some species of *Lacerta* in Africa, and on that continent, in India, and in Southern Europe, the genus *Acanthodactylus* is represented. Its species have the toes keeled beneath or fringed along their edges. Long-tailed, cylindrical-bodied Lizards are also found in the East Indies and in Africa, and they belong to the genus *Tachydromus*. The genus *Ophiops* contains Lizards without palatal teeth and eyelids, and the type is an inhabitant of Asia Minor.

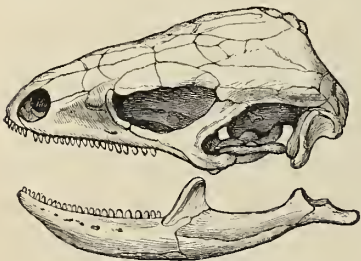
* *Lacerta viridis*.

† *L. ocellata*.

‡ *L. muralis*.

NOTE.—If these common Lizards are taken as the types of the order Sauria, or Lacertilia, the distinctions between them and the Crocodilia on the one hand, and the Serpents, or Ophidia, on the other, can be appreciated. The skull of the Lizard, shortened as it is in relation to that of the Crocodile, possesses the following peculiarities:—The lower jaw is jointed

with a quadrate bone, on either side, which is not firmly united to the skull, for the union admits of some movement there. In this respect the Lizards differ from the Crocodiles, but this mobility is in excess in the Serpents. In the Lacertilia the pterygoid bones reach from the palatines and sphenoid backwards and outwards to join, but not to unite firmly to, the quadrate bones; but this is not the case in the Crocodiles, and the joining is in the nature of a very movable joint in the Serpents. In the Sphenodon, one of the Lacertilia, this union is bony, and there is no mobility. On the palate of the Saurians, the inner nostrils or posterior nares are well in front, and the vomers limit them internally, and the palatine bones externally. The palatine bones do not unite along the median line, as in the Crocodile, except in the Sphenodon, and the vomers are distinct in the Lacertilia. There is a transverse bone uniting the palatine and pterygoid with the maxilla in the Lacertilia and Snakes. The basi-sphenoid, has a projection on either side, which passes downwards and



SKULL OF LIZARD.

Common observation instructs us that many Lizards leave their tails behind in the hand of their incautious captor, without seeming any the worse for this singular loss of much of the organ. The vertebrae of the tail are not solid and bony, for there is a space running right across each, in its middle, formed of gristle, or even of cellular tissue, and this gives way nearest the point of greatest stress upon the tail; which snaps off, to be re-produced, however, again.

Certain skin glands exist, and are seen at the surface along the inner part of the thigh as pores (femoral and inguinal pores), and others exist in front of the vent. They secrete a reddish fatty substance, which often hardens in the duct leading to the pore, and forms a visible projection.

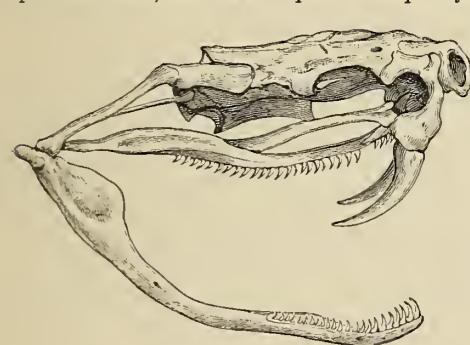
The teeth of the Saurians are on the pre-maxillæ, maxillæ, and the dentary pieces of the lower jaw or mandible, but they often occur also in the pterygoid and palatine bones.

It was mentioned that the teeth of the English Lizards are *pleurodont*. This is a term which implies that the teeth are attached to a kind of parapet of bone which is placed on the jaws. The teeth are inside this, or between it and the cavity of the mouth, and are attached to it, each tooth by one side, and they are therefore not placed in sockets.

This arrangement is common to several groups of the order, and others have what is called an *acrodont* dentition. That is to say, the bases of the teeth are on and are attached to the top of the parapet, and not to its side. The teeth are numerous and simple in structure, and their crowns have very different forms, being sharp, blade-like, or broad, rounded, and crushing, according to the

outwards to join the commencing backward prolongation of the pterygoid. This is seen in the Snake also, but not in the Crocodile; but the junction, perfect in the Lizard, is movable in the Serpents. In the Lizards the space between the

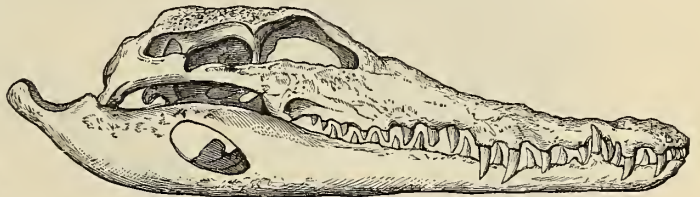
prootic bone and the pre-frontal, unlike the bony condition of the Crocodile, is filled with cartilaginous membrane. There is an imperfect bony division between the orbits, and the parietal bones form the front part of the roof of the brain-case, and the occipital the back, hinder, and part of its lower portions; they are not united by sutures or fixed in a perfectly motionless manner, but there is a membranous interspace, which permits of some movement of the face and fore part of the skull on the occipital bone. This is very different to the rigid condition of the skull of the Crocodile and to the solid structures of that of the Snake. On looking at the upper part of the Lizard's skull a number of distinct openings are seen. One, the *supra temporal fossa*, is bounded by the parietal, post-frontal, and the squamosal bones; and there is a *post* and *temporal fossa* existing between the parietal, the occipital, and a process called the parotic. This process is at the back and side of the skull, giving it an angular appearance. It is present also in the Crocodiles, but it is not found in the Snakes.



SKULL OF RATTLESNAKE.



PLEURODONT JAW (IGUANA), FROM WITHIN.



SKULL OF CROCODILE.

A small unossified space, the *parietal* foramen, usually exists between the parietal bones and the frontals.

There is also a *lateral temporal fossa*. The Lizards have the skin over the *supra temporal fossa* more or less bony, and it follows that, as in the Crocodile and Chelonians, there is a kind of light outer skull-case, the true brain-case being very small and opening behind at the foramen magnum, where there is, on the basi-occipital bone, at its junction with the lateral occipital bones, the solitary condyle for the jointing with the atlas or first vertebra.

With regard to the lower jaw, the two sides of it are usually united at the chin (or symphysis), and each is composed of six bony pieces. This number is common to the Reptilia, but the junction in front, seen also in the Crocodile, is not observed in the Snake, whose lower jaw is singularly separable from its fellow on its opposite side. Finally, in concluding this notice of the skull, it is necessary to

mention that the pre-maxillæ and maxillæ are firmly united with each other and the skull, and that there are two vomers.

Most of the Lacertilia have two small rod-shaped bones, one on either side within the skull. Each extends from a parietal bone to the pterygoid nearest to it, and is in close contact with the membranous or cartilaginous wall of the skull. It is called the columella, and its presence is of classificatory value.

family or sub-order. New teeth are usually formed below the old ones. Some fossil kinds were probably *thecondont*, or their teeth were in sockets.

The second family of the sub-order Fissilingues is formed by the AMEIVIDÆ. Living in the New World, these large reptiles have the head plated, rhombic scales on the back, and transverse rows of square ones on the belly. The tail is long and cylindrical in some and compressed in others. The limbs are well developed; the teeth are powerful and obliquely placed; there are two transverse folds in the skin of the lower region of the neck, and usually there are femoral pores. The COMMON TEGUEXIN,* or



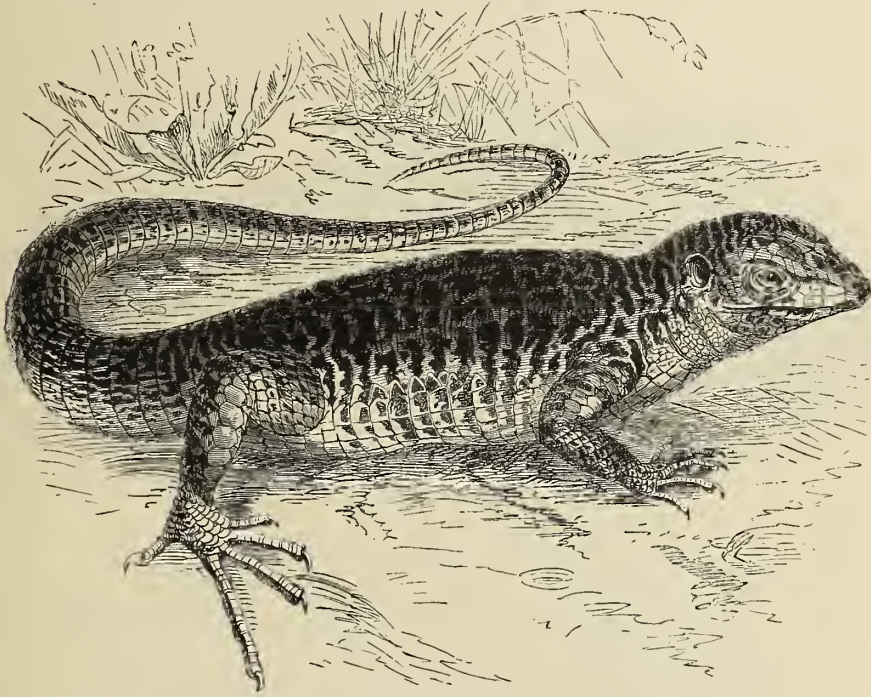
THE COMMON TEGUEXIN.

South American *Sauvegarde*, may be taken as an example. It grows to more than a yard in length, and has been said to attain four feet six inches, and the colour is variable on the back, where it is always black, so far as the ground tint is concerned, but the beautiful yellow spots may be scattered and small, or large and dispersed in cross bands, with a large spot on the flanks. The sprinkling is seen often on the head and tail, and this is ringed with yellow and black. All the lower parts are yellow, and are marked across with black bands. They have a great range in South America, from Guiana to Paraguay inclusive, and are abundant, being found in sugar plantations and woods, and in the Brazils in sandy or clayey districts, amongst scrub and bush. Often liking the neighbourhood of the rivers and water, and running on the banks, they do not appear to go into the water readily, but they can swim gracefully, using the tail as a propeller.

Usually they burrow under the roots of trees, and they keep very much to the same spots, living often in the hollows of trees. Azara says that when pursued they take to the water, and do not climb, but it is doubtful whether they ever swim. They are strong, and swift in movement, not over bold,

* *Tejus Teguexin* (Linn.)

but when attacked by dogs will fight and make their tails felt. Running swiftly close to the ground, they sit with the head rather erect. They keep their tongue in very constant movement, but it is very doubtful if they ever emit a warning sound, as some suppose they do, on the approach of wild beasts. The nests of the White Ant, which have been built close to the fallen trees on the outskirts of the forests, are cleared out by the Teguxin, and her eggs, some fifty or sixty in number, are laid therein. Azara says that they feed on fruit, insects, snakes, frogs, young birds, and eggs, and that they are fond of honey; and in captivity they devour meat and mice, and are not amenable to kindness. The genus *Tejus* may be distinguished by the large hexagonal scales which are between the neck folds, and by the long and narrow ventral plates.



THE COMMON AMEIVA.

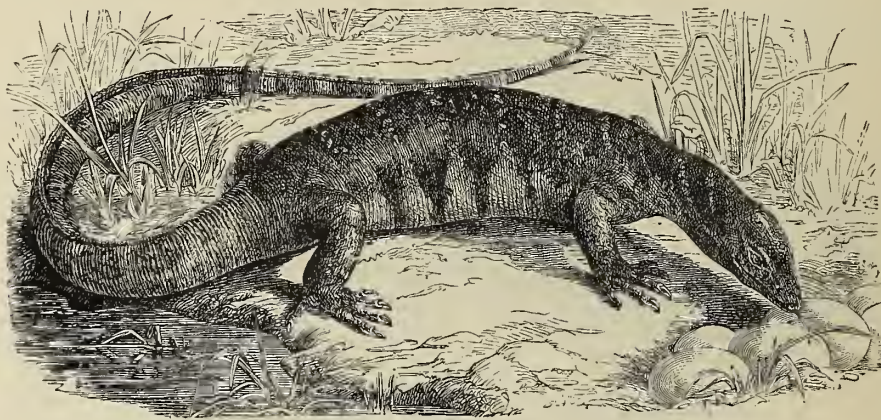
The members of the genus *Ameiva* have large ventral scales and tricuspid and compressed teeth. *Ameiva vulgaris*, or the COMMON AMEIVA, is from the West Indies.

The largest known Lizards belong to the family of WATER LIZARDS, MONITORIDÆ, or Platynota. They are long-headed things, with a vast number of small scales, united more or less at the sides and not over-lapping, and which are equal on the sides and back, and arranged in cross rings, whilst those of the belly and tail are square and in cross bands. The tail is long and generally compressed, and there are five digits to the well-developed limbs armed with claws. The smallness of the shielding of the head is remarkable, but the scales everywhere are usually surrounded by a ring of very small tubercles within their margin. The tongue is long, slender, and ends in a long fork, which retreats into a sheath at the base. The teeth are acute and compressed, triangular or conical, and none are on the palate. They differ from the other Lacertilia, except the American genus *Heloderma*, which is included in the group, in that the nasal bones are represented by a single narrow ossification. Growing to a considerable size, these largest of the scaly Lizards are found in the Old World, including Africa, South Asia, and in Anstralia, and there are several genera of them. Some keep entirely to the neighbourhood of water; but others select dry and sandy spots, not always near water. They prey on small reptiles, small mammals, the eggs of reptiles, and will not refuse insects.

They are called Monitors, from it being supposed that they warn people of the neighbourhood and approach of the Crocodile. The warning is said to be a strong hiss, or whistle. But the truth

appears to be that they are often associated with the Crocodiles in the same waters, and give no warning whatever. The NILE MONITOR, or *Varanus*,* grows to a length of six feet, the tail forming one half. The head is rather long, and the nostrils small and rounded; the tail is keeled on the top, and compressed from side to side, and the fourth toe is the longest, and contrasts with the small fifth one. The reptile has no web to its feet, crawls about watery places, and suns itself on the sand. Known to the ancients as a devourer of Crocodiles' eggs, the Monitor is not restricted to the Nile, although it reaches into Nubia, for it, or a closely allied species, is found in the great rivers of the West, and is known also in South Africa.

In this locality it is generally discovered on the banks of rivers or margins of lakes, and it plunges in the instant it is disturbed; and if the water is deep the Monitor remains quiet there until the danger is past.



THE NILE MONITOR.

THE SAND MONITOR, OR VARANUS.†

This is an Egyptian kind which, instead of frequenting the banks of the rivers and the water, lives in dry places. It is less carnivorous than the Monitor of the Nile, and its food, although consisting of eggs to a certain extent, is more insectivorous.

Another terrestrial kind is from South Africa. When it is surprised it seeks concealment in the chinks and crevices of the ground, holding on to any projections with its toes, so as to require much force in withdrawing it. A single man is not sufficient for the task, even with a rope attached to the hind legs by way of assistance.

It appears to feed on frogs, crustacea, small mammalia, and is often found near running streams. It is called the White-throated Monitor.‡

Amongst the Varani with nostrils, or an oblique slit placed quite, or nearly, in the middle of the face between the eye, and the end of the snout, are some from India.

The Common Indian Water Lizard§ sometimes attains the length of four feet, the tail being longer than the body, and it is of a brownish olive colour, with more or less numerous black dots, each of which occupies a scale. It is found in Bengal, Nepal, Southern India, and in Ceylon, where it is called the Goana. Kelaart says that "it is found in great abundance in all the maritime provinces, but rarely in the Kandian districts. The natives are partial to its flesh, and we have once tasted some excellent soup made from a Goana, which tasted like hare. They live in holes and come out in mid-day after their food, which consists of smaller reptiles and insects. They attack ant-hills, and at Trincomalee they used to be hunted down by dogs and sold in the market."

The Ocellated, or the Two-banded Water Lizard,|| lives in China and Siam, and it is said to occur in Ceylon. Cantor says it is very numerous in hilly and marshy localities in the Malayan

* *Monitor (Varanus) niloticus*.† *Monitor*, or *Psammosaurus arenarius*.‡ *Monitor (Varanus) albogularis*.§ *Monitor (Varanus) dracæna*.|| *Hydrosaurus salvator*=*Varanus salvator*=*Monitor bivittatus*.

Peninsula. It is commonly observed during the day in the branches of trees overhanging rivers, preying on birds and their eggs, and on smaller Lizards, and when disturbed it throws itself from a considerable height into the water, and it will defend itself courageously with teeth, claws, and strokes of the tail. The lowest castes of Hindoos capture these Lizards by digging them out of their burrows on the banks of rivers, for the sake of their flesh, which is greatly relished by these people. Some individuals attain to nearly seven feet in length.

A Monitor, with bright-yellow spots covering five or six scales, and dotted over the whole body, is found in New Guinea and the Darnley Islands,* and a closely allied genus (*Hydrosaurus*), in which the nostrils are placed at the extremity of the snout, is represented there also.

The Gigantic Lace-Lizard† and its varieties are common examples of Australian kinds.

The other section of this group of Monitors, with a single nasal bone, is represented by the very ugly Lizard called *Heloderma horridum*, of Mexico. It has rather a flat head covered with numerous great convex polygonal plates, which give it a very tubercular appearance.

The *Heloderma*, reaching to three feet and a few inches in length, is called Escorpion by the natives, and moves principally by night. In captivity it prefers flesh to vegetables, does not like the water, and it hibernates. Like most of its order, it is very tenacious of life, and the muscles move long after decapitation, and chloroform is long in killing them.

THE SUB-ORDER CRASSILINGUES.—THE SHORT-TONGUED LIZARDS.

These Lizards have a short, thick, and fleshy tongue, slightly notched in front and not protractile. There are four limbs present, and their digits are placed in front of the ankle and wrist. Usually the eye is protected by lids, and the tympanic membrane is free. They have, with the exception of one family, the Geckos, procœlous vertebræ and a columella, but the teeth may be pleurodont, or acrodont. The first family of this great sub-order is that which contains the IGUANAS (the Iguanidæ).

* *Monitor chlorostigma* (Gray).

† *Hydrosaurus giganteus*.



THE IGUANA.

A large Lizard with a beautiful green-coloured back, yellowish-green sides and belly, with brown stripes or zigzags lined with yellow, and with its long tail ringed with green, yellow, and brown, has a crest of tooth-like spines on the back and tail, a "bag" under the jaw, also crested, long toes, and a rather compressed body. The head is moderately long, and has its top protected with plates, and is raised between the eyes, and is more or less pyramidal in form. The neck is short, and there is a fold of skin on it behind the "bag" which is reflected over the shoulders.

This description applies to the large GREEN IGUANA,* which may be from three to five feet in length. On looking at the mouth it is observed that the numerous teeth are fixed along the internal face of the dentary bone, to which they adhere by one side of their bony root, and that they are remarkable in shape. They are "pleurodont." They are rather long, compressed from side to side, and are broad at the top, where they are angularly arched, pointed at the tip, and finely denticulate on the slope on either side. The tympanic membrane is large and circular.

These Iguanas live an arboreal life in tropical America and the West Indies, and are often brought to Europe, and kept in zoological gardens and menageries. Climbing with ease and moving with great rapidity amongst the foliage, they do not hesitate to take to water, the neighbourhood of which they usually seek. They swim with ease, entering water voluntarily, and they do not then use their fore limbs, but principally the tail. Brown, in his travels in Guiana, noticed the Iguana on the trees overhanging the rivers, and that they were greatly alarmed at the noise of the boat's paddles. They threw themselves from the branches into the water, many coming down broadside on the surface. Harmless things, they still will show fight, and the lash of their tail gives pain. Their food is not confined to vegetable diet, and as they have a row of teeth on the pterygoid bones, they can readily capture and swallow small grubs and insects. Nevertheless, the insectivorous diet is the most usual, although the blade-like serrate teeth are suited for biting leaves.

The body of each vertebra is procœlous, that is to say, hollow in front and convex behind, the hollow of one vertebra fitting into the convexity or ball of the one in front of it. The arch of bone of each vertebra through which the spinal cord passes is attached to that of the vertebræ in front and behind, by the ordinary oblique articular processes, which permit of a certain amount of motion of the individual bone between its neighbours,† and of a general amount between all the vertebræ. In order to prevent dislocation during rapidly complicated or contorted movements an additional structure is provided, whose use, however, is not so apparent in the Iguana as it is in the Serpents. There is a projection on the front of each arch which fits into a pit on the hind face of the preceding arch,‡ a peg-and-socket joint being formed.

It is remarkable that in all the Iguanidæ of the New World the teeth are pleurodont. But there are others in which the teeth are acrodont, and their possessors are inhabitants of the Old World, the great Asiatic Islands, and Australia. The habits of all are much alike.

A fine Cychura§ lives in Cuba, which has a back crest, an extensible throat, and a very long compressed tail with rings of spiny scales, and the Crested Anolis|| has the digits enlarged and united at their base, and the throat sac is very extensible. It has none of the glandular structures in the fold of the thigh which are seen in most of the groups.

The most curious of all these American Iguanidæ is called the BASILISK,¶ and might be taken for an heraldic rather than a real and living active tree Lizard. If it were twelve feet in length instead of as many inches it would not be unlike a mediæval Dragon without wings, and even in its small development it looks very uncanny. Its broad and rather sharp-pointed scaly head has a tall cap-like crest sticking up and back from the hinder part. A tall, thin, fin-like movable crest with spines on it passes along the back, being highest over the loins, and there is a corresponding one on the top of the long tail. The body is scaly and marked in zigzag. There is a very marked fold of the skin on the throat, and the hind digits are fringed at their sides. It inhabits Central America.

The genus AMBLYRHYNCHUS is represented in the Galapagos Islands, and the information about its species is due to Charles Darwin, who writes in his celebrated Journal:—"This Lizard** is extremely common on all the islands throughout the Archipelago. It lives exclusively on the

* *Iguana tuberculata*.

† These articular processes are called *Zygopophyses*.

‡ They are called *Zygosphenæ* and *Zygantrum*.

§ *Cyclura carinata*.

|| *Anolis occipitalis*.

¶ *Basiliscus mitratus*.

** *Amblyrhynchus cristatus*.

rocky sea-beaches, and is never found—at least, I never saw one—even ten yards in shore. It is a hideous-looking creature, of a dirty black colour, stupid and sluggish in its movements.” The usual length of a full-grown one is from a yard to four feet, and they may weigh twenty pounds. These Lizards were occasionally seen some hundred yards from the shore swimming about. And when in the water the animal swims with perfect ease and quickness, by a serpentine movement of



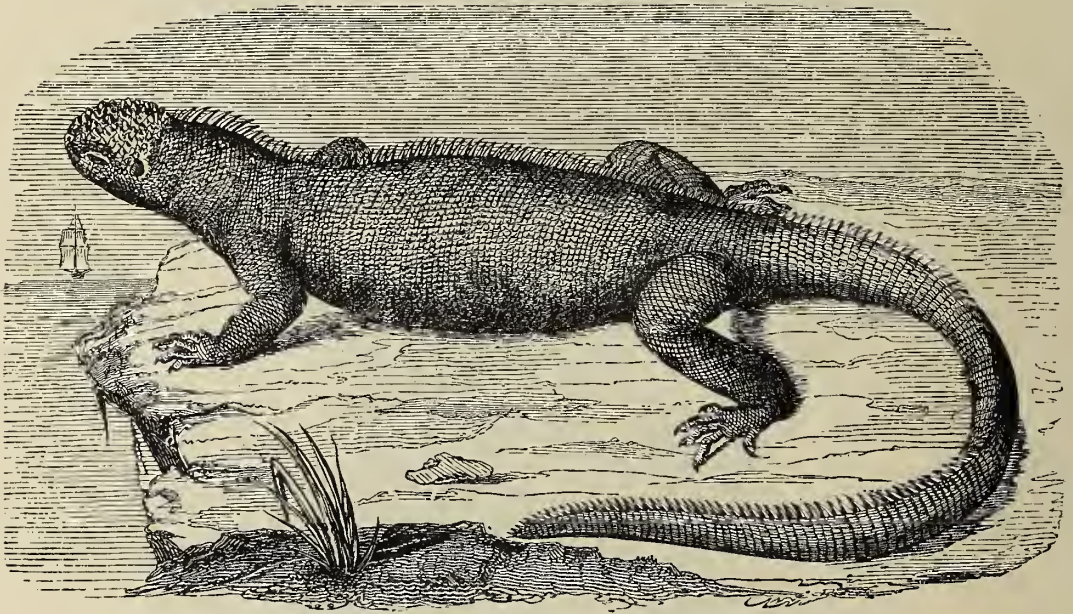
THE BASILISK.

its body and flattened tail, the legs, during this time, being motionless, and closely collapsed on its sides.

Mr. Darwin writes also :—“ Their limbs and strong claws are admirably adapted for crawling over the rugged and fissured masses of larva, which everywhere form the coast. In such situations a group of six or seven of these hideous reptiles may oftentimes be seen on the black rocks, a few feet above the surf, basking in the sun with outstretched legs. I opened the stomach of several, and in each case found it largely distended with minced sea-weed, of that kind which grows at the bottom of the sea, at some little distance from the coast.” It is very remarkable that these Sea-Lizards should object to be driven into the water, but such is the case.

A species of the genus leads a terrestrial life on the same islands, and is the *Amblyrhynchus subcristatus* (Gray). This species, writes Mr. Darwin, "differently from the last, is confined to the central islands of the Archipelago, namely, to Albemarle, James, Barrington, and Indefatigable. To the southward, in Charles, Hood, and Chatham Islands, and to the northward, in Towers, Bindloes, and Abingdon, I neither saw nor heard of any. It would appear as if this species had been created in the centre of the Archipelago, and thence had been dispersed only to a certain distance. In the central islands they inhabit both the higher and damp, as well as the lower and sterile parts; but in the latter they are much the most numerous. I cannot give a more forcible proof of their numbers than by stating that when we were left at James Island we could not for some time find a spot free from their burrows on which to pitch our tent. These Lizards, like their brothers, the sea kind, are ugly animals, and are a little smaller."

The second division of the family of Iguanidæ relates to those Iguana-like creatures which have



AMBLYRHYNCHUS CRISTATUS.

acrodont teeth, that is to say, the teeth are placed with their bases on the top of the jaw-bones without sockets. They are nearly all inhabitants of the Eastern hemisphere and of Australia. One of the most interesting is a little representation of the Dragon of the mediæval Eastern imagination. There are many species of these "Dragons,"* but they are restricted to the East Indies, and they are more numerous in the Archipelago than in the Continent. They have not yet been found in Ceylon. The character, according to Günther, by which the FLYING LIZARDS may be at once recognised, is the peculiar additional apparatus for locomotion, formed by the prolonged five or six hind ribs, which are connected by a fold of extensible skin, the whole forming a sub-semicircular wing on each side of the body. They have a long, pouch-like, downward projection of the skin from the throat, and a small horizontal fold sticking out on either side.

They live in trees, jumping from branch to branch, and expanding their back-parachutes. They move rapidly and safely over some distance. When running along a branch, or resting, the back folds of skin are laid backwards along the flanks. They run but seldom, but jump and leap vivaciously. The skinny appendages of the throat are merely appendages of the skin, and may be compared with the wattles of birds: they are not hollow, but they are connected with the hinder horns of the hyoid bone, and can be erected or spread out when the animal is excited by rage. The

* *Draco volans*.



FLYING LIZARDS.

trunk is rather slender, and is covered above and below with very small keeled scales. Large spaces on the parachutes are naked and separated by stripes of minute scales. The tail is long, slender, tapering, and not breakable. The hands are slender, and each has five long, thin, clawed toes. It is said that the transcendent beauty of their colours baffles description. As the Dragon lies in shade along the trunk of a tree, its colours at a distance appear like a mixture of brown and grey, and render it scarcely distinguishable from the bark. Thus it remains with no signs of life, except the restless eyes watching passing insects, which, suddenly expanding its wings, it seizes with a rapid leap. The outer part of the upper surfaces of the "wings" is ornamented with large irregular black dots on an orange or rose-coloured ground, fringed with silver. Besides this, the structure of the wing produces iridescent tints, and they flash as they move through the air from branch to branch. The throat and sac are bright yellow, dotted with black, and the side folds are silvery, rose, or yellow. Below the wing are light brown or black spots. This colouring applies to the description of the common species of Java, Sumatra, Borneo, Penang, and Singapore. The spotted *Draco*, with the lower part of the wing whitish, with sometimes an isolated black spot, is continental, having been found in Siam; and *Draco Dussumieri* is the kind found in the forests of the west coast of Hindostan.

Mr. Moseley noticed the habits of this Flying Lizard in the Philippine Islands. They frequent the lower trees. They spring from tree to tree, and from branch to branch, but they pass through the air so quickly that the extension of their parachute is hardly noticed during the flight. He states:—"We had several of them alive on board the ship for a day or two, where they flew from one leg of the table to another."

The FRILLED LIZARD* is one of the remarkable Australian animals which, whilst possessing the structures common to others found elsewhere, have a peculiar and almost anomalous conformation. Mr. A. Cunningham, in his Journal on "Australian Discovery under Capt. Parker King, F.R.S.," describes the capture of the first specimen, which was taken off a branch of a tree, in Careening Bay, Port Nelson:—"I secured a Lizard of extraordinary appearance, which had perched itself upon the stem of a small decayed tree. It had a curious crenated membrane, like a ruff or tippet round its neck, covering its shoulders, and when it was expanded, which it was enabled to do by means of transverse slender cartilages, it spreads five inches in the form of an open umbrella. Its head was rather large, and the eyes, whilst living, were rather prominent; its tongue, although bifid, was short and thick, and appeared to be tubular." Captain King stated that the colour of the tongue and inside of the mouth was yellow. The frill arises from the hinder part of the head, and is attached to the sides of the neck and extends down to the front of the chest. It is supported above by a lunate cartilage arising from the hinder part of the ear, and in the centre by a bone which extends about half its length, and is a prolongation of the hyoid. There are four plaits in the frill, and the front edge is serrated; the outer surface has keeled scales, and the inner is quite smooth. The colour of the long-tailed creature is yellowish-brown variegated with black. It has long toes which are very unequal, and the claws are hooked and horn-coloured.

The next family of the Crassilingues contains those thick-tongued Lizards which are terrestrial and not arboreal in their habits, and which have the body broad and flat and the skin covered more or less with spiny scales. They are principally dwellers in deserts and sandy places, but some are found in damp situations, and are called the Agamidæ. One group is restricted to the Old World and Australia, and another to the New World. They differ in the position of the teeth, those of the Old World being acrodont, and those of the New World pleurodont, but it is very remarkable that some of the genera of the one hemisphere should be represented in the other by forms which resemble them in many points of structure and habits.

THE TERRESTRIAL AGAMIDÆ OF THE OLD WORLD AND AUSTRALIA.

The Thorn-tailed Agamas form the genus *Uromastix*, and they have the body clothed with small scales and a large flattish tail ornamented with rings of large spiny scales, which contrasts with the rest of the rather smooth body. The Dabb, or Dhobb,† of the Arabs is one of them, and is at least

* *Chlamydosaurus* (King).

† *Uromastix spinipes*.



THE FRILLED LIZARD.

a foot in length, and it appears to have a very wide distribution over the desert tracts of Palestine, North Africa, and the sides of the Red Sea.

Only one kind of this genus *Uromastix* lives in India, inhabiting rocky plains, reaching some thirteen inches in length. It is found in Western India and not in Bengal.

In Bushire, Major St. John found these Lizards sitting outside their holes in the evening, and a British terrier with him killed two, one of which had attacked him. They are generally very gentle, and are vegetable feeders, possessing a long intestine.

The extraordinary prickly-looking Lizard of Australia, which is called the Thorn-devil, or Horrible Moloch,* belongs to this group, and is about six inches or less in length. Its little head is horned with prickles of large size, and rows of them exist on the bulged-out body. They are on the tail in crests, as it were, and on the limbs.

There is a North African genus of this group which extends into Western Asia. One of the species is from Afghanistan,† but the commonest one found in Egypt is spineless, and the scales of



THE DABB, OR DHOB.

it are small, there being no pores on the inside of the thighs. It is interesting from the habit which it has of puffing out its body so as to enlarge its dimensions, and from the gift of being able to change its colour even more promptly than the Chamæleons.‡

A fine Lizard, known to the ancients, belongs to the genus *Stellio*. In Egypt§ it attains the length of more than two feet, and it has a flat swollen body, and the tail is ringed with scales which are spiny on the tip of it. A dweller in the desert and rocky districts, it is also an inhabitant of Palestine, and is said even now to extend into Turkey and the Islands of the Ægean, and possibly it is found in Cyprus.

The next group of the terrestrial Agamids is essentially American. In their shape and habits these large and squat-bodied Lizards resemble those just noticed from the Old World and Australia, and the first of them to be noticed—as the Toad Lizards—are closely allied in structure and method of life to the Moloch of Australia. One of these, called the Tapayaxin,|| is very toad-like in the shape of its

* *Moloch horridus*.

† *Trapelus megalonyx*.

‡ *Trapelus Egyptiacus*.

§ *Stellio spinipes*.

|| *Phrynosoma orbicularis*.

body; its head is very short, rounded in front, square, and about as broad as high: the neck is short and the tail is short and pointed. It is not as prickly as the Moloch, but there are eight sharp radiating spines on the back of the head, and rows of scales keeled and spined on the flanks. The head is of a red-brown colour, yellowish beneath, spotted with brown, more or less, and the upper part of the body is of a dull sand tint or leathery colour. There is a large brown spot on either side of the throat,



THE MOLOCH.

and the back is spotted with the same colour, and the spines are brownish. The length of this very ugly reptile is under six inches. It appears to live on insects, and to inhabit the hill country of Central Mexico. Another kind, of which a specimen was in the Zoological Gardens, is the Horned Lizard,* which comes from Texas.

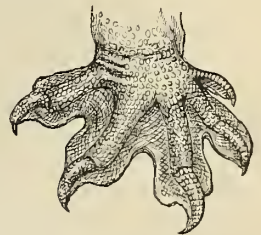
THE GECKO FAMILY.—THE ASCALABOTES, OR GECKOTIDÆ.

Curiously-shaped thick-bodied Lizards, with clawed, flattened-out toes, running up straight walls and hunting spiders inside houses, were common objects of natural history to the Greeks, and Aristophanes, and Theophrastus called them ἀσκαλαβώτης, a name perpetuated by Aristotle. They are interesting on account of their very world-wide distribution, for they are found in the hottest parts of the Americas, of Europe, Africa, Asia, Australia, and Oceania, and in several of the larger islands, and this diffusion, insular and continental, together with the amplexicel nature of the bodies of their vertebræ,† indicates the antiquity of the group.

Species of one genus of the family may be seen near home, in Southern France, and in most Mediterranean countries, and a common kind, which scampers up and down walls, runs along the ceiling, and holds on and turns where the surface is often slippery and upright, belongs to the *Platydaetyli*. It is

* *Phrynosoma cornutum*.

† That is to say, they are hollowed out in front and behind.



TOES OF GECKO.
(a) Under surface.

from four to six inches in length, with a long rounded tail, a flat, plump body, short neck, and each of the rather frog-like limbs ends in five large splay digits, four of which have sharp claws. The head is very broad behind the eyes, which are large, prominent, and have an iris with a vertical slit, and the snout is short. When it runs, which it does with great rapidity, the body is kept low and the limbs are stuck out, and when it moves over upright surfaces, or runs along back downwards, the flat expansion of the toes and fingers, and the minute sharp claws, enable it to cling on where other things, except insects, would fall. The digits are short, and their bones, very equal in length, are so arranged that they fit into the wrist and ankle so as to radiate, as it were, from a common centre to form nearly a complete circle. The great toe cannot separate itself from the others to extend itself backwards. The lower part of the digits is much dilated and widened, and so is the sole generally.



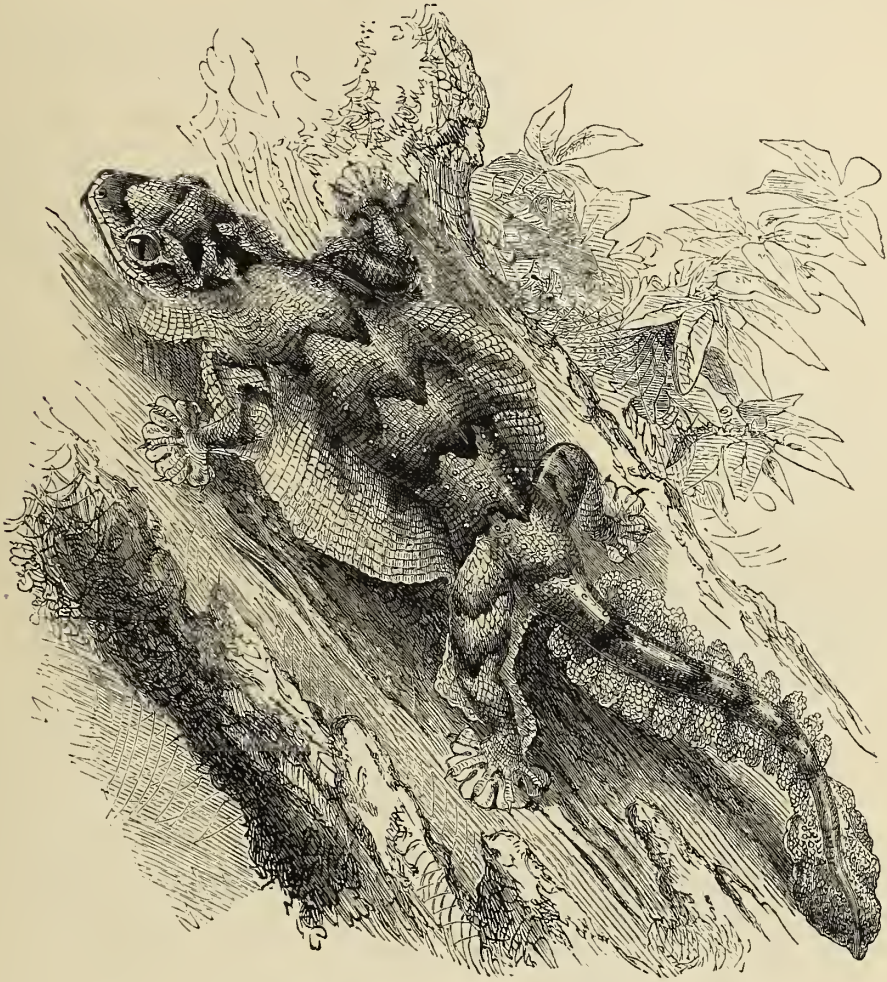
THE TURKISH HEMIDACTYLE.

This membranous expansion of the skin is furnished with small plates, like scales, following, or overlapping each other in a regular manner, and there is great variety in this arrangement in the different genera and species. Sometimes the rows of plates are continued right across the under part of the digit, one behind the other; in others they are more or less curved, or there may be a longitudinal line separating the continuity of the line, and producing festooning or angulation. In the common Gecko the markings are in simple cross lines. The nails, which pass over the top of the expansion before they become free and terminal, are very movable and cat-like, and assist materially in holding on, by getting into minute crevices and cracks, whilst the expansion itself acts more or less after the fashion of a sucker of the feet of some Insecta. It is certain that the Gecko will remain fixed with some amount of force in antagonism to that of the gravitation of its body.

They can cast loose in an instant, and when the hand is just upon them they vanish, as it were, under the eye of their expectant captor. In some of the family there is considerable membranous fringing of the body, tail, limbs, and digits, and in a Californian kind* these last are almost as much

* *Phyllodactylus tuberculatus*.

webbed as those of a Tree Frog. The Geckos and all the family have the skin loose, and it is not covered with true scales, as in the Common Lizards and most other Reptiles. There are leathery tubercles rounded and sometimes projecting on the skin, and many minute delicate rounded bodies are found in its thickness. But it is usually soft, and its colours may be grey or yellowish, and there are lovely tints of blue, green, and red in some. The males, as a rule, are more brightly coloured than the females, but in both instances the sombre tints allow the prey to be caught readily; for the Geckos will climb to some apparently inaccessible place, wall, tree, or rocks,



THE FLYING GECKO.

whose colour assimilates with theirs, and will remain perfectly stationary until the unwary insect or spider comes within the range of their attack. Or they will creep out of their hiding-place and pounce upon larvæ, and dig out pupæ from crevices. They are fonder of twilight and nocturnal wandering than moving by day, and they usually feed at night. They have no scaly or leathery eyelids, only a rim of soft lid, but there is a delicate tissue which can be passed over the eyes like a nictitating membrane. The pupil is usually cat-like, and enables the Gecko to hunt by day and night, but in some genera it is round, and eminently adapted for purely nocturnal vision. The tongue is, of course, a short thick one, very slightly forked in front; and as it moves it can drag up the glottis to the palate, so as to form a clicking or clucking sound, something like the word *gek, geko.* Hence the name of the genus and family. The teeth are numerous and pleuro-

dont, that is to say, they are placed in a furrow on the internal edge of the jaws, the roots adhering to the bone by their outsides and below. No teeth are found on the palate, and the creatures catch their prey with their jaws and teeth, and bolt it whole. All the family are harmless, active little things, but popular ignorance and superstition have given them very bad characters, and they are said to produce eruptions of the skin if they run over anybody with their soft, flabby, viscous little toes.

One of the French Geckos belongs to the genus *Platydictylus*, which is also represented in Spain,* and has the fourth and fifth digits only clawed, but the others of the genus in China, Egypt, and some other places on the continent have only one digit without a claw.

All the Geckos are fierce, and love fighting, and rob each other, if possible, of their prey. They are carnivorous, and will kill and eat their smaller fellows, and even their own and other tails fall victims. They will come to be fed at appointed times if some care is taken.

A species which has claws projecting beyond all its thick expanded fingers is found in the hotter districts near the Mediterranean Sea. The scales on the under part of the tail are not unlike those of Serpents, and the underneath part of the disc-like digits has the little plates separated by a middle line. The wart-like tubercles on its skin, and the nature of the clawed fingers, have given it the name of the *Hemidactylus verruculatus*. It is also known as the Turkish Hemidactyle.

The Common East Indian Gecko is very widely distributed in British India, Siam, Cochin China, and Southern China, and in the Archipelago. It is not found in Ceylon.† It has the habits of the family, but it springs on to its prey like a little Carnivore.

The Flying Gecko‡ is a very handsome kind, of some seven inches long, and is found in Java and in a few other islands of the Archipelago. The expansions of its skin have the same purpose as the corresponding structures of the Dragons and Flying Squirrels. In leaping they are expanded by the pressure of the air from below, and act as a parachute, and when the creature is at rest they are kept in close contact with the body. Cantor says that these Geckos have some power of colour-changing.

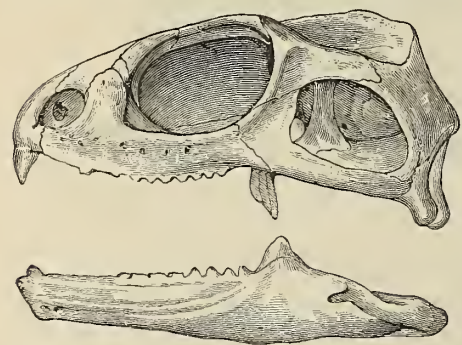
SUB-ORDER RHYNCHOCEPHALA.—THE BEAKED LIZARDS.

THE TUATÉRA, OR HATTERIA, OR THE SPHENODON LIZARD.

This remarkable reptile from New Zealand was first mentioned in a diary by Mr. Anderson, the companion of Captain Cook, but Dieffenbach gave the first coherent narrative about it (1843):—"I had been apprised of the existence of a large Lizard which the natives called Tuatéra, or Narara, with a general name, and of which they were much afraid." He did not find it so common; and from all he could glean, it appears that it was common formerly in the islands, lived in holes, often in sandhills near the shore, and that the natives killed it for food. Owing to this latter cause, and no

doubt to the cultivation of pigs also, it is now very scarce. The specimen he had was extremely sluggish, and could be handled without any attempt at remonstrance or biting. This Lizard has a large head and a great eye, and a crest of separate, white, flat, sharp spines.

We owe to Dr. Günther a magnificent description of the anatomy of the *Sphenodon* and its comparison with the extinct reptiles of the ages of the Trias, which are called *Rhynchosaurus* and *Hyperodapedon*. It is an acrodont, and the teeth are so united with a sharp edge of the maxillary and palatine bones as to appear mere projections of them. These edges are, as it were, hard and polished, and are used as cutters when the teeth have



SKULL OF SPHENODON, OR HATTERIA, SHOWING ACRODONT JAW. (After Günther.)

worn off. The pre-maxillary bones have a beak-like form, and their large teeth (notched at the crown) become fused with their substance, and somewhat resemble those of a Rodent in shape. There is a remarkable row of teeth on the palate-bone, and the teeth of the lower

* *Platydictylus fascicularis*, known as the *Gecko des murailles*.

‡ *Gecko guttatus*.

† *Ptychozoon homalocephalum*.

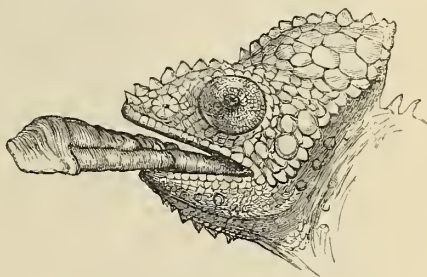
jaw bite in between it and the row of the upper maxillary teeth, in a long groove. By friction during some years of mastication these three sets of teeth become worn, so that those on the lower jaw, or mandible, are ground to an edge, and the others on their inner and outer faces respectively. There is great solidity of the large skull at the jaw-joint, and the quadrate bone is fixed to the side of the head, whilst the squamosal, quadrato-jugal, and pterygoid bones are (unlike in all other Lizards) united by bone. Moreover, they are strengthened by the ossification of a membrane which, in Lizards, extends between the quadrate, the pterygoid, and the skull, and bounds the front walls of the cavity of the ear. The bodies of the vertebræ are hollow in front and behind, and there is a remarkable system of sternal and abdominal ribs. These Lizards appear to eat large insects and small ground birds.

THE SUB-ORDER VERMILINGUES.—THE CHAMÆLEONS.

The Lizards of this sub-order are most remarkable in their appearance, anatomy, physiology, and habits, and the well-known Chamæleon, so grotesquely formed, and so changeable in its colours, is the type of the only family of it—the *Chamæleonidae*.

The species are numerous, and are found in Southern Europe, Africa, Asia Minor, Hindostan, and Ceylon. There are no less than twenty-one species in Madagascar. Lately it has been proposed to form them into two genera, one of which is Chamæleon and the other Rhampholeon.

The Chamæleon has been thus termed after its curious designation by the Greeks. They called it χαμαιλέον, or Small Lion, and yet a more significant name might have been given to it, for Aristotle described the strange creature with his usual great accuracy. It is one of the most extraordinary looking things in Nature, and its flattened body is surmounted by a crest of toothed skin on the thin back. The neck is creased, and the head is triangular in outline, having a pyramidal top. The eyes are large and glaring, and look in different directions, being, moreover, covered with skin except in their centre. The ears are not visible, and the mouth is a slit. A long, compressed, pointed, prehensile tail is usually twisted around some object by way of safety, and the fore and hind feet have digits divided into fore and aft sets, and they clasp their supporting bough very much after the fashion of some birds. The skin is soft, knobbed, or tubercular, lax on the creature, and is like a minutely scaly shagreen, and its colour changes in a very remarkable manner. Usually very still, slow, and quiet in their movements, the Chamæleons can suddenly protrude an extremely long, fleshy, cylindrical, worm-shaped tongue, with a curious lobed cup-shaped end, and thus catch insects with singular rapidity and certainty. Indeed, it is the most active part of the animal, which, usually hidden up under leaves, or on boughs much resembling it in colour, does not chase its prey, but watches and waits until an insect comes within the length of half of its body and tail, and then suddenly it protrudes its long tongue, and the victim is stuck fast to it by a viscid secretion. When the tongue is withdrawn it brings the insect into the mouth, and it is then packed away in a groove in the hard palate. The teeth are acrodont in position. The position of the body is high on its legs.



HEAD OF CHAMÆLEON, SHOWING THE TONGUE.

The lungs are of great size, and the front costæ unite with each other on the rudimentary sternum, and the others, including those of the loins, complete their path around the abdomen. This permits of the extraordinary size and expansion of the lungs at the will of the animal, by which, filling itself with air, its outside tissues become, as it were, transparent. This enlargement of the cellular structure of the lungs passes air into air-vessels distributed about the body, and increases the size and plumpness of the creature, which can be diminished rapidly when the air is expelled.

The Common Chamæleon is found in Southern Spain, and the north and south of Africa; also in Asia Minor, many parts of Hindostan, and in the northern parts of Ceylon. Most of the Indian specimens are of a green colour, uniform, or irregularly spotted and banded with dark green or brown, whilst in African specimens the ground colour is greyish-olive, yellowish, or brownish. The "grains"



THE CHAM-ELEON.

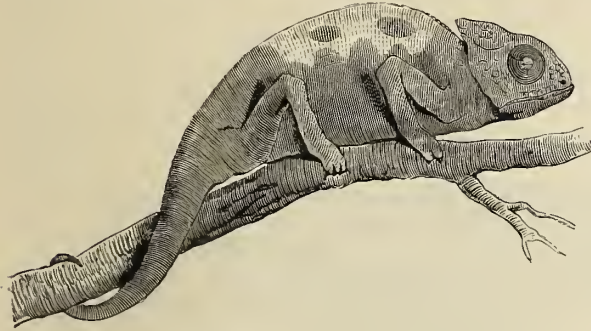
of the skin are equal and close, and the crest on the upper part of the body is toothed as far as the middle of the back, and that on the lower part, as far as the vent.

There are many species or varieties of Chamæleons in Africa besides the common one.* The Island of Madagascar has a vast number of them included in several species, and probably one-third of those known are found there. One of them is called the Rhinoceros Chamæleon, from the male having a horn-like tubercle at the end of the muzzle. Another, described thence by Günther, has a tail which is so short that it cannot be used as a prehensile organ,† but this is compensated for by the presence of an additional projection at the inner base of each claw, and of a spine projecting from the side of each finger and toe, structures which add to its powers of claspings and holding on. The Three-horned

* *Chamæleon vulgaris*.

† Forming the genus *Rhampholeon* (*Rhampholeon spectrum*).

Chamæleon* is from Fernando Po, and the male has a long horn over each eye, and another at the end of the muzzle. Günther's *Chamæleon montium* has its male with two nearly straight horns projecting horizontally in front of the nostrils, and their sheath is finely annulated; the horns are half as long as the head. It has a high crest on the back and part of the tail. In the female the horns are mere projections. The colour is a mixture of yellow, green, and black. With regard to the habits of the small South African kind, and to its viviparous nature, Moseley writes in his "Notes on the *Chal-*



SLEEPING CHAMÆLEON UNDER LAMP-LIGHT, WITH DORSAL PART PROTECTED BY A SCREEN.

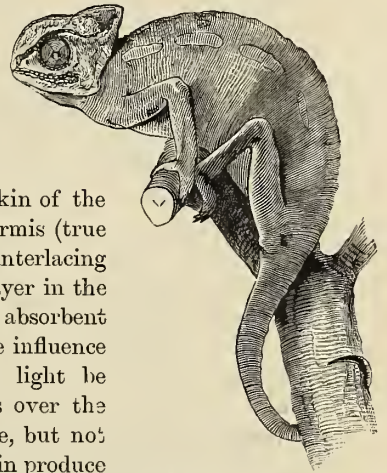
(Unprotected portion in this experiment is of darkish green colour; protected portion appears like a brownish saddle.)

The changing of the colour of its skin by the Chamæleon has made the curiously-shaped reptile most interesting. This power is not restricted to them, however, but they possess it above all other reptiles and amphibians. The change of colour appears to be produced to a certain extent by the will and passions of the Chamæleon, by an involuntary habit which enables its tints to correspond with the natural substances on which it is placed, and also to have some relation in certain cases to the sun's rays. The skin, so readily stretched and inflated by the enlarging lungs, may be rendered thin, transparent, and some of it more vascular than the rest.

There are minute corpuscles of different colours in the skin of the Chamæleon, which are sometimes hidden in the depths of the dermis (true skin), and sometimes spread out on its surface layers in a kind of interlacing network. There is also a yellow colouring-matter, and a bluish layer in the skin becoming yellow by transmitted light, and blue on an absorbent ground. Now, during sleep, or if the reptile is placed under the influence of chloroform, the whole body becomes yellowish-white. If light be allowed to fall on the reptile thus situated, a dark tint comes over the skin. The light coming through dark blue glass does the same, but not through red and yellow glasses. Sections of nerves and of the brain produce remarkable changes in colour, and it appears to be the case that the various colours and tints assumed are due to the change of position of the coloured corpuscles which, according as they bury themselves under the dermis, or form an opaque ground beneath the cœrulescent layer, or spread out a superficial ramification, either leave the skin its yellow colour, or give it green and black colours. The movements of the corpuscles are governed by two kinds of nerves, some of which cause them to travel from its depths towards the surface, while the others produce the opposite effect. When greatly irritated these corpuscles conceal themselves beneath the true skin. This is also the case in sleep and death and anæsthesia.

* *Chamæleon Oweni.*

lenger":—"A small Chamæleon is abundant everywhere on the hedges near Cape Town, South Africa. We had one alive in the ward-room; it was quite tame, and rested quietly on a bunch of twigs, hung up to the lamp rail, and would whip flies out of one's fingers, at a distance of at least four inches, with its tongue. It gave birth to three young ones one night. They twisted their tails round the twigs on which the mother was reposing, at once, and directly began catching flies; but our house-flies were too big for their mouths to swallow, and they had to chew away at them for a long time before they could get any juice out of them." Most species lay eggs under leaves.



CHAMÆLEON UNDER SUN-LIGHT PASSING THROUGH RED AND BLUE GLASS, LIGHT PASSING THROUGH RED GLASS FALLING ON FORE PART OF BODY, AND THAT PASSING THROUGH THE BLUE ON THE HIND PART.

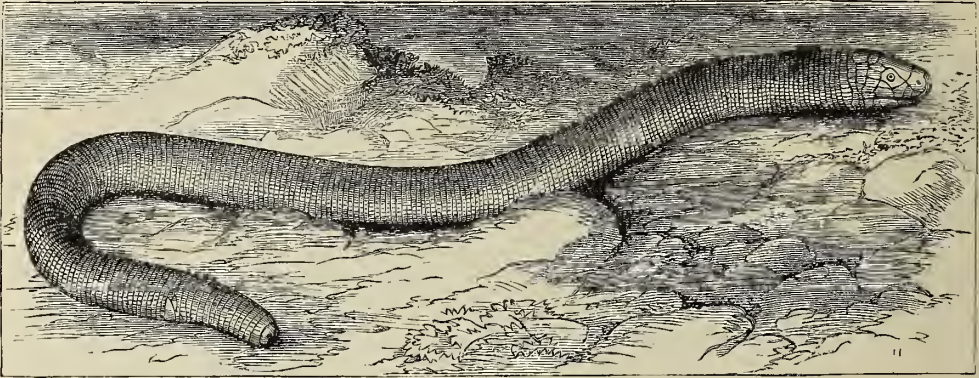
(In this experiment the body seems to be divided into two parts, the anterior of a clear green with no spots, the posterior of a darkish green.)

It is evident that the luminous rays belonging to the blue-violet region of the spectrum act directly upon the contractile matter of the corpuscles, causing them to move and approach the surface of the skin.*

SUB-ORDER AMPHISBÆNOIDA.

The White Amphisbæna,† which may be considered the type of this remarkable group, is a snake-like animal, without arms or legs, and these the natives suppose it was born with and has lost. The word is from the Greek *ἀμφίσβαινα*, which means an animal that can walk in both directions, and the reptiles can move forwards or backwards with their very worm-like bodies. They are not Snakes, however, but really belong to the Lacertilia.

The White Amphisbæna, or Ibijara, is a Brazilian kind, and has the cylindrical worm-like body of the group, being about as thick as one's finger, the head and tail not being distinguished



THE WHITE AMPHISBÆNA.

readily by careless and frightened observers. It grows to the length of one foot six inches, or to one foot nine inches, the tail, or that round part behind the vent, being from an inch and a half to two inches only in length. On looking at the body, a great number of rings of hard, glassy-looking skin, made to look scale-like by markings in regular longitudinal lines, are seen. The result of the markings and disposition in rings is to produce a mosaic of quadrangular false scales, and they are very equal in size; and after skin-shedding has taken place are glossy and rich in tint. The mouth is small, the muzzle is round, and the head is rather flat on the top, and there are two large separated nasal plates and two pairs of frontal plates behind them. The eye is very small, and covered with thin skin, and the limbs are deficient. Burrowing easily in the ground and in ants' nests, the Amphisbæna preys on small things, and has a short thick tongue without a sheath. The genus *Blanus* has a more worm-like species than Amphisbæna.

One of this sub-order has a very small pair of arms with four digits, situated just behind the head, but there are no legs. This is called *Chirotos canaliculatus*, and is about eight to ten inches in length, and as thick as the little finger. It appears to burrow, and to live on insects in its worm-like life. In these Amphisbænoida the vertebræ are procœlous, and there is no sacrum, and all the vertebræ in front of the tail, except the one or two nearest the skull, have ribs. Their internal anatomy is more like that of the Chamæleons than any other group.

SUB-ORDER BREVILINGUES.—THE SCINCROIDÆ AND ZONURIDÆ.

Some of these might readily be taken for Lizards, and others for Snakes, so variable is the shape. They are a harmless set of beings, some having, however, undeservedly very bad reputations.

* It is a point of some importance to recognise that the hemispheres of the brain, by the intervention of the involuntary (reflex) nerves, govern the colour-deciding nerve—those which move the corpuscles—and it would appear that this involuntary action relates to what is seen by the eye of the opposite side of the body.

† *Amphisbæna alba*.

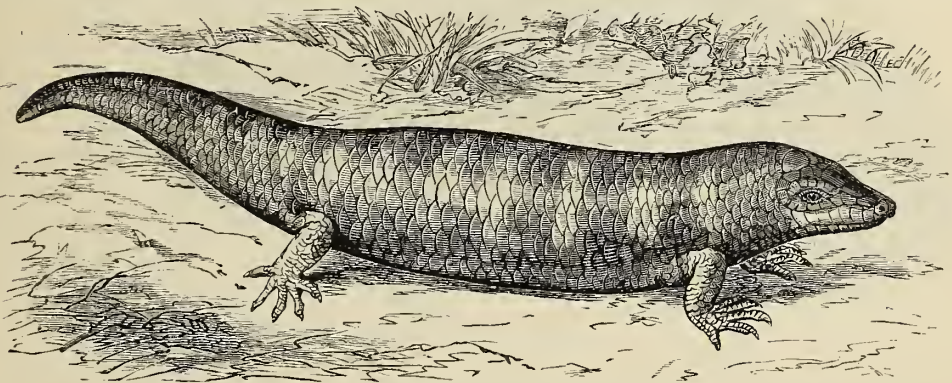
They are not venomous, and some live above and others much under ground, preying on worms and insects. Some of them are to be found in every part of the tropics, and in some parts of the temperate zones, but certain genera are restricted to particular regions. They are called Scincoids. Those Scincoids which resemble Lizards more than Snakes have fore and hind limbs ending in hands and feet furnished with five digits, which are clawed. The serpentiform kinds have no limbs visible; and between them and those just alluded to are kinds with only the rudiments of the hinder limbs. Some of these have no toes, and others have two toes on the ill-developed feet; and there are a few with fore and hind limbs, but without their extremities. A smooth, scaly outside hides, even in the kinds where no limbs exist, imperfect and rudimentary shoulder and pelvic girdles of bone or cartilage. When limbs are present these bones are well developed, for instance, in the Lizard-like kinds. Some have very sharp eyes, and one or more well-grown eyelids; others have the eyes very small and covered and hidden by skin; and a few have very small or no eyelids. Those with well-developed and movable eyelids have the opening of the tympanum visible, but in the others it is covered up. Whether the body is furnished with limbs, or is worm or snake-like, there are always large scales or plates on the fore-part of the head, arranged symmetrically; and the body and limbs are covered with scales, which may overlap or not. They all have a short, thick, very slightly extensible tongue, which is flat, and more or less notched in front where it is thinnest. It is often scaly, or covered with scale-like elevations, and has no sheath.

As a sub-order of the Lacertilia, these creatures may be divided into two families. One* contains those whose general description has just been given; and the other includes the kinds which have an extensible fold of skin on either side of the body, furnished with small scales, and which reaches from the ear to the vent, and divides the back from the abdomen. They have large plates on the top of the head, and there are large scales on the back arranged in whorls, and there are eyelids and a visible tympanic membrane, as a rule. Lizard-like and serpentiform kinds are found in both families.

The first division comprehends the Skinks, and this family contains the genus *Scincus*, and many others. The species are very numerous, and inhabit almost every part of the tropical regions, some extending into the temperate zones. They are thoroughly land Lizards, preferring dry ground, and hiding themselves in the sand and under stones. None of them enter the water. They do not attain to any considerable size, a few West Indian and Australian species growing to the thickness of a man's wrist, and being a foot long. They deposit from eight to twelve globular eggs.

THE COMMON SKINK.†

This is a Lizard-like kind with short limbs and long body, and a conical and pointed short tail.



THE COMMON SKINK.

The head is small for the stout neck, and is wedge-shaped; the muzzle is flat, and the upper jaw is long, and the eye has a lower lid which is not scaly. On looking at the extremities, the four feet

* *Scincoidæ*.

† *Scincus officinalis*.

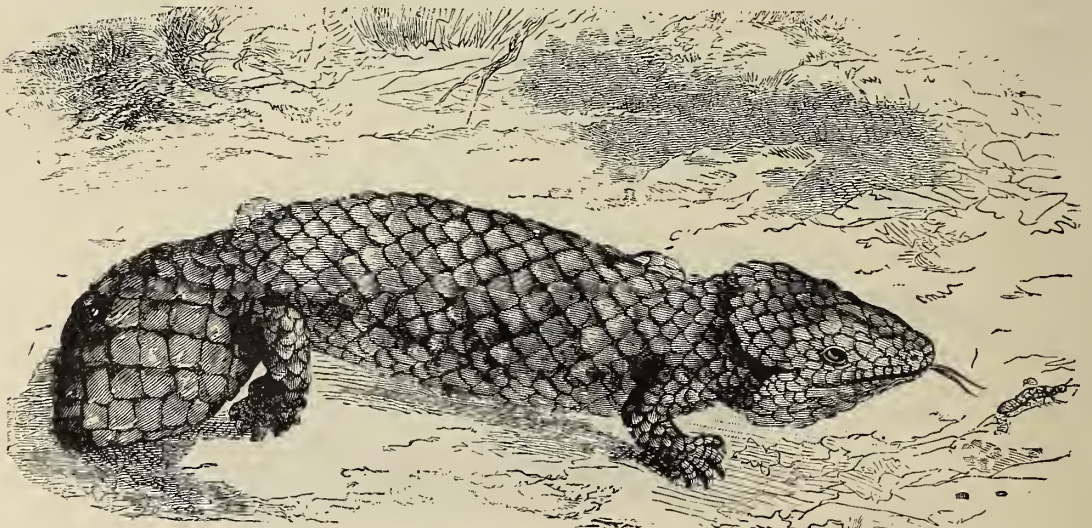
will be seen to be furnished with five clawed scaly endings. They are flat and saw-like at the edges, a large scale being over the base of the nail.

The Skink inhabits the western and northern parts of Africa, and they are found also in Senegal, in Abyssinia, on the other side of the Continent, and in Egypt, and Bruce met with it in Nubia. It likes a warm place, and frequents the little hillocks of fine and light sand that the wind accumulates at the foot of hedges that border the cultivated lands, and of the tamarisks which try to vegetate on the confines of the desert. There it may be seen comfortably basking in the rays of the burning sun, and chasing, every now and then, the beetles which crawl within its range. It runs very quickly, and, when menaced, buries itself in the sand with great rapidity, hollowing out for itself a burrow many feet deep in a short time. When taken it endeavours to escape, but does not attempt to bite or to defend itself with its claws. Probably they attain five inches in length.

This little creature was once of use to the physician, although of doubtful value to the patient. It was dried and powdered and given as a remedy, or specific, against almost every malady, by the Greeks and Romans. Pliny wrote that the scales of the nose and the feet, after being powdered and boiled in white wine, were to be used as particular stimulants; and Apelles used parts of the animal as antidotes against the wounds inflicted by poisoned arrows. Up to the sixteenth century the reptile led an unhappy life, being chased, and taken, and swallowed; but gradually its medicinal virtues were disproved, and it now lives in peace.

A Scincoid* which lives in the New World has its head of a bright-red colour, and the body and tail are olive; the throat and abdomen being yellowish-white. It is about thirteen inches in length, and is found from latitude 39° to the Gulf of Mexico, in the Atlantic States, as well as in Mississippi and Louisiana. It frequently takes up its abode in an old nest of the Woodpecker, out of which it thrusts its head in a threatening manner. Seldom coming to the ground, it is shy, but fierce when taken, and bites severely.

Australia has some remarkable Scincoids, and one, which is called the Stump-tailed Lizard,† is very curious from the extraordinary resemblance which the tail bears to the head when the eyes are closed with their scaly lids. Visitors to the Zoological Gardens frequently say that the



THE STUMP-TAILED LIZARD.

creature has two heads, when it is motionless, in its cage. It has a long stout body and blunt head and tail, four small limbs and short digits. The body in its upper part, and the head and tail, are encased in large, rough, broad scales. The lower eyelid is minutely scaly, and the eye is bright, of a brown colour, with splashings of yellow occasionally. Underneath the body the scales are smaller and lighter-coloured, and the ear is not visible.

* *Plestiodon erythrocephalus* = *Scincus americanus*.

† *Trachydosaurus rugosus* (Gray).

It is very common in some parts of Australia, for instance, in Western Australia, particularly in the neighbourhood of King George's Sound, but they do not inhabit the east coast; at all events they are not found near Sydney.

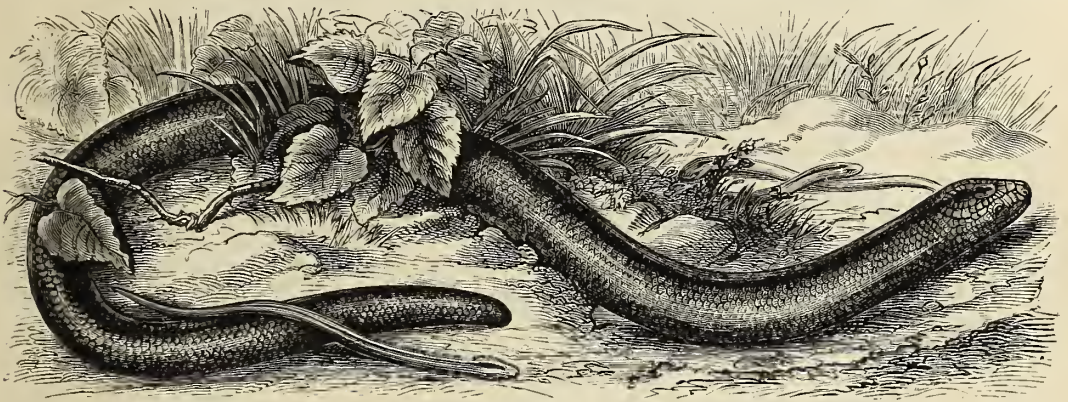
It is generally known as the "Sleeping Lizard," and it frequents open, sandy plains, and may be captured in large numbers on a hot summer's day.

The number of young produced seldom exceeds four.

The large Australian Lizards, with broad crushing spheroidal crowns to their teeth instead of sharp points, belonging to the genus *Cyclodus*, are allied to the last-mentioned kinds, and have many curious structural arrangements in common. They are the Great *Cyclodus* from Australia, which breeds in the Zoological Gardens of London, and the Black-and-yellow *Cyclodus*, from Tasmania.*

GENUS ANGUIS.—THE BLIND-WORM, OR SLOW-WORM.†

The late Mr. Thomas Bell, in his interesting book on the "British Reptiles," states that the Blind-worm, or Slow-worm, is found in almost every part of Europe, excepting the extreme north,



THE BLIND-WORM.

and is capable of enduring a much colder climate than most other reptiles, even of our own country. It is found in Russia, Poland, Denmark, Sweden, and Scotland, as well as throughout the more temperate parts of Europe as far as the South of France and Italy, but it has not been seen in Africa. It is worm-like in shape, long, and almost of equal thickness throughout, but it tapers slightly at the tail end. The teeth are very small, and are slightly hooked. The tail is not more than half the length of the body in some individuals, but it is longer in others. It may reach from ten to fourteen inches in length, and the head measures half an inch or more. The general colour is brownish-grey with a silvery glance, and there is a dark line down the back. The history of one is given in White's "Selborne:"—"A Blind-worm that I kept alive for some weeks would, when touched, turn and bite, although not sharply. Its bite was not sufficient to draw blood, but it always retained its hold until released. It drank sparingly of milk, raising the head when drinking. It feeds upon the little white slug so common in fields and gardens, eating six or seven of them one after the other, but it did not eat every day. It invariably took them in one position. Elevating its head slowly above its victim, it would suddenly seize the slug by the middle, in the same way that a ferret or dog will generally take a rat by the loins. It would then hold it thus sometimes for more than a minute, when it would pass its prey through its jaws, and swallow the slug head foremost. It refused the larger slugs, and would not touch young frogs or mice. The Blind-worm avoided the water, and was a remarkably fine one, measuring fifteen inches in length." They are very timid when first caught, and they contract their muscles so forcibly that they become stiff, and it is when in this rigid condition that the body is easily broken in two by a blow, or by an attempt to bend it. Hence the name fragile, or fragilis. The females are ovo-viviparous, there being some-

* *Cyclodus gigas* and *Cyclodus nigro-luteus*.

† *Anguis fragilis*.

times from seven to twelve young. The young are very active, and are only from eighteen to twenty lines in length at first, but they grow quickly, and soon learn to eat slugs and insects.

GENUS ACONTIAS.—THE ACONTIAS.*—THE JAVELIN SNAKE.

This is a small snake-like member of the group of Scincoids, more so, indeed, than the Blind-worm and Australian Pygopus, for it has no traces of rudimentary external limbs or of internal shoulder and pelvic girdles. The head, however, is that of a Lizard, and there is only a lower eyelid. The body is cylindrical and serpent-like, but it is covered only with small scales; and the jaws are not capable of extension, and the teeth are small and conical. The tongue is scaly and slightly notched at the point. These snake-like Lizards are harmless, and endeavour to escape on the least alarm, by hiding under leaves, or even getting down into dry soil like the Blind-worm. They have the appearance of a Snake when still and on the ground, but their method of progression is by carrying the head and front part of the body erect. They have the power of darting suddenly, and in a horizontal direction in striking, and this was magnified in a ludicrous manner by the ancients, who confounded many real Snakes with them, and gave them a very bad character.

The lungs of this creature are not equally developed, one being, as in the Serpents, longer than the other; but the anatomy of the jaws distinguishes them from the Snakes.

Another snake-like creature, not without some resemblance to an Acontias, is from South Africa. It has its eyes hidden beneath the skin, and has a cylindrical body, a short truncated tail, and is of a yellowish tint, reticulated with violet. This *Typhlina Cuvierii* has no limbs.

The Pygopus,† a snake-like form, is occasionally met with in Australia, but on the whole it is rare. Its flat tongue, the two flap-like rudimentary limbs near the vent, without toes to them, and its ear-holes, easily distinguish it from a true Snake.

Very little, if anything, is known of its habits; but it is one of the interesting Saurians which has apparently degenerated towards the Serpents. It has rudimentary bones of the shoulder girdle and sternum, and the ill-developed hind limbs project and are visible enough. The length of the Pygopus is about two feet.

THE ZONURIDÆ.

The second family of the Brevilingues contains forms which have the shape of short-limbed, long-bodied, and tailed Lizards, and others which are serpentiform, having only rudimentary hinder limbs. They have a marked peculiarity which relates to their method of life. Their body is covered with scales, which are squarish on the back, and rounder on the belly, but they do not overlap, and are in cross-bands one behind the other, and closely applied. The food consists of worms, insects, small mice, and little reptiles; and certainly it could not be swallowed or comfortably digested were all the cross-bands of the body continuous. The skin is not extensible, as in the other Saurians, and there is a region at the side of the body, where there is a long fold covered by small scales, and this part can be stretched, although the rest is rather rigid. The Lizard-shaped kinds are numerous, and can be best illustrated by considering the genus *Zonurus*, or *Cordylus*, which has large head scales, and four limbs with five digits.

The Cordyles of South Africa are very numerous as individuals, and there are many species, some excessively repulsive in appearance, from their ragged, scaly covering, and others less so, on account of their appendages being small and smooth about the body, although those of the tail are mostly spined and keeled.

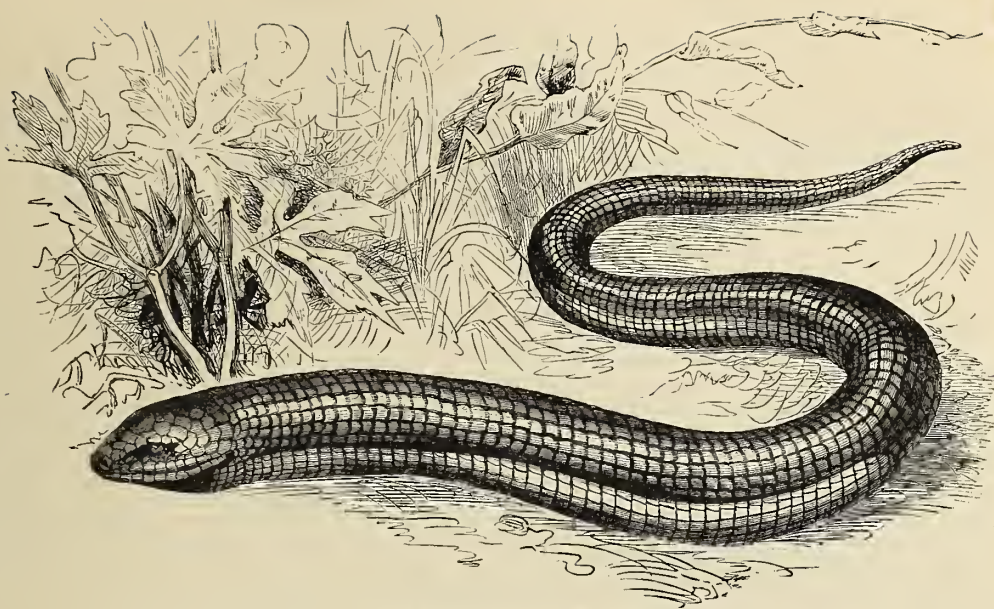
The Gigantic *Cordylus*‡ reaches fifteen inches in length, and is therefore large for the group, and it is readily known also from its dark umber-brown sienna, and straw-yellow-coloured scales, which are mostly large, and covered with large or small spines, or keeled. The zones or bands of scales on the body are more strongly spined on the flanks, and they are large, distinct, and spiked on the tail. It inhabits the interior districts of Southern Africa, and is not unfrequently seen on the rocky pinnacles of the Quothlamba mountains which separate the country of the south-east coast from that of the interior.

The serpentiform kinds of this division are numerous, and some of them are called Glass

* *Acontias meleagris* (Cuvier).

† *Pygopus lepidopodus*.

‡ *Cordylus giganteus* (Smith).



THE SCHELTOPUSIK (*Pseudopus Pallasii*).

Snakes, partly from their very snaky appearance, partly because they are glassy in tint, and principally on account of their brittleness.

The European *Pseudopus* is a common example, and it is called the Scheltopusik (*Pseudopus Pallasii*, Cuvier). It has been found in Central Russia, in Europe, Hungary, and in Dalmatia, and is a dark, chestnut-brown, glassy snake-looking creature, reaching the length of two feet. It has the rudiments of the hind limbs, in which a small femur is hidden, and they have no digits. Internally, there are traces of the shoulder and pelvic girdles, and one lung is a quarter less in size than the other. This species lives on insects, small mice, worms, and frogs.

An American Glass Snake (*Ophisaurus ventralis*), very small, breakable, and limbless, belongs to this group, and has no hind limbs. It reaches twenty-eight inches to three feet four inches in length. It chooses dry places, passes much of its time in holes, and is often dug out of the earth with the sweet potato at harvest time. It moves with considerable swiftness, and is found from Virginia to Cape Florida, and ranges to the Mississippi, and as far as Michigan.

CLASSIFICATION OF THE ORDER SAURIA, OR LACERTILIA, OR LIZARDS.

SUB-ORDER 1. FISSILINGUES . .	{	FAMILY 1. LACERTIDÆ . .	Example: <i>Lacerta agilis</i> (Sand Lizard).
		„ 2. AMEIVIDÆ . .	„ <i>Tejus Teguxin</i> (Teguxin Lizard).
		„ 3. PLATYNOTA . .	„ { <i>Monitor Niloticus</i> (Nile Monitor). <i>Heloderma horrida</i> .
„ 2. CRASSILINGUES . .	{	FAMILY 1. IGUANIDÆ. (Pleurodont) . .	„ <i>Iguana tuberculata</i> (Tuberculated Iguana).
		„ (Acrodont) . .	„ <i>Draco volans</i> (Flying Dragon).
		„ 2. AGAMIDÆ. (Acrodont) . .	„ <i>Moloch horridus</i> (The Horrid Moloch).
„ 3. RHYNCHOCEPHALA . .	{	„ (Pleurodont) . .	„ <i>Phrynosoma cornutus</i> (Horned Toad).
„ 4. VERMILINGUES . .	{	„ 3. ASCALABOTES . .	„ <i>Platydictylus fascicularis</i> (Gecko).
„ 5. ANNELATA	{	FAMILY 1. SPHENODONTÆ . .	„ <i>Sphenodon</i> (Tuatéra). Hatteria.
„ 6. BREVILINGUES . .	{	FAMILY 1. CHAMÆLEONIDÆ . .	„ <i>Chamæleon vulgaris</i> (Chamæleon).
		FAMILY 1. AMPHISBÆNIDÆ . .	„ <i>Amphisbæna alba</i> (the <i>Amphisbæna</i>).
		FAMILY 1. SCINCOIDÆ . .	„ <i>Scincus officinalis</i> (the Common Skink).
		„ 2. ZONURIDÆ . .	„ <i>Pseudopus Pallasii</i> (Scheltopusik).

CLASS REPTILIA, THE REPTILES.

CHAPTER IV.

ORDER OPHIDIA.—THE SNAKES.

THE SNAKES—The Poisonous and the Non-Poisonous—Characteristics of a Snake—Serpent Worship and Superstition—About Fascination—Skeleton of a Snake—Scales and Plates on Head and Body—Moulting—THE POISONOUS COLUBRINE SNAKES—THE POISONOUS TERRESTRIAL COLUBRINE SNAKES—THE COBRAS—The Cobra-di-Capello—The Egyptian Cobra, or Naja—THE RING HALS SLAG—THE HAMADRYAD SNAKE—THE BUNGARUMS AND KRAITS—The Poisonous Elapidae of Australia and the New World—THE POISONOUS SEA SNAKES—THE VIPERINE SNAKES—Characters—THE ADDER, OR COMMON VIPER—The only Poisonous Reptile in Britain—Habits—Its usual Prey—Its Young—The Horned and other kinds of African Vipers—The Daboia—The Echis—THE RATTLESNAKES, OR PIT VIPERS—The Common Rattlesnake—Its Habits—The “Rattle”—The Water-rattle—Various Kinds of Rattlesnake—Cues on the Use of the Rattle—The Bushmaster—Darwin on the Genus *Trigonocephalus*—The Water Viper—The Copper-head Snake—The Yellow Viper, or Fer-de-Lance—The East Indian Genera of Pit Vipers—How Venomous Snakes Dispose of their Victims—Peculiar Construction of their Skull for Swallowing purposes—The Fangs and Poison-glands of the Rattlesnake—Symptoms of Poisoning—How does the Poison kill?—Treatment of Bites—Snake-Charmers—THE INNOCUOUS COLUBRIFORM SNAKES—Characters—THE WART SNAKES—THE WHIP SNAKES—Why so-called—The Langaha—The Blunt-headed Snakes—THE TREE SNAKES—THE DESERT SNAKES—THE RACHIODONT FAMILY—An Egg-swallowing Snake—Fresh-water Snakes—THE COLUBRIDES—NATRICINÆ—The Common Snake—Found in England—Habits—How it Disposes of its Food—COLUBRINÆ—CORONELLINÆ—CALAMARIDÆ—THE ROCK SNAKES—Distribution—Huge Proportions—How they Tackle their Prey—The Indian Species—The West African Forms—Pythons Hatching their Eggs—The Diamond and Carpet Snakes—The Boas—The Boa Constrictor—Construction of a Python's Skull—The Anaconda—THE SAND SNAKES—THE SHORT-TAILED SNAKES—THE BLIND SNAKES—Characters—Peculiarities of Structure in Serpents—The Remarkable Eyelid—Fossil Snakes—Classification of the Ophidia—THE EXTINCT REPTILES—THE DINOSAURIA—THE ORNITHOSAURIA—THE ICTHYOPTERYGIA—THE PLESIOSAURIA—THE EXTINCT SAURIA, OR LACERTILIA—The *Archæopteryx* a Lacertilian (foot-note).

A LITTLE Snake,* with rows of black spots on the back and sides, a yellow splash behind the head, and pale lead or bluish underneath, may be seen now and then in quiet, warm places in England basking on banks in the sun or sliding in or out of a pond. It is often made a pet of, and is harmless to man, although a terror to frogs, but even to them it is not poisonous. It lays eggs. It is the common Harmless Snake. Another one,† found on dry heaths and sandy banks, and amongst low brushwood and thickets, has the neck rather smaller than the back of the head, which is enlarged behind the eyes; and the long body swells to about its middle, and then scarcely diminishes in thickness to near the end, where it becomes abruptly smaller. Its colour may be olive or rich deep brown, or dirty brown-yellow, and there is a zigzag pattern down the sides, and spots of a darker tint. Little ones may be found with it, and it produces the young in the living condition. This is the Viper, or Adder, and it inflicts fatal wounds with its fangs upon small animals like mice, and its poison will imperil the life of delicate and unhealthy men. Common observation can thus separate the Snakes of our country, for there are only these, into two divisions—the innocuous and the poisonous—and this classification holds good for the Snakes of the whole world; and special anatomical characters are found in the last group, making the distinctions all the more obvious and real. Thus in India there are many very pretty Snakes which swallow small living prey, without the teeth introducing a poison, and there are also the terrible Cobras, and many others, which can destroy the life of man, or of large animals, in a few minutes, by the agency of a drop of fluid which enters the wound with the teeth. The same observation is true in Africa and America, and it is found that many of the innocuous Snakes crush their prey in the folds of their long bodies, whilst the poisonous inflict a wound which they seem to know will be fatal, and when the victim is dead, or in its last struggle, it is swallowed whole. Probably there are 1,300 kinds of Snakes in the world thus separable into the harmless and poisonous, or, more properly, into the non-poisonous and the poisonous, for the great Pythons and Boas are dangerous to man by their squeezing and claspings; moreover, they bite fiercely, but do not inflict a poisoned wound.

Many Snakes in tropical climates live a forest life, climbing on and moving amongst the trees, and are usually beautifully coloured. They are long in the body, very active, and are very properly called Tree Snakes. Most of them are not provided with poison fangs, but some have them, so that the great primary divisions of the Snakes are present. But it is found that some of these poisonous kinds are not viviparous like the Vipers or Adders, and they bring forth eggs like the

* *Tropidonotus natrix*.

† *Pelias berus*.

innocuous Snakes. Moreover, there are some peculiar anatomical arrangements in them not noticed in the Vipers. Hence, the poisonous Snakes are divided into two groups—the Viperiform Snakes and the Venomous Colubrines—and the innocuous Snakes are the True Colubrines.

A great number of Snakes live on the ground, rarely, if ever, taking to trees. They have a very flexible body, which is more or less cylindrical in shape, and amongst them are Vipers (Viperiform Snakes), venomous Colubrine Snakes, and innocuous Snakes (Colubrine Snakes). In fact, all the divisions. A few harmless Snakes (Colubrines) live a burrowing life under ground, and have rather a rigid, round body and a small mouth. Finally, there are several kinds of Water Snakes. Those which frequent fresh water are harmless Colubrines, but those which live in the sea are all poisonous, and belong to the venomous Colubrines, and not to the Viperiform division. All have a long, forked, protractile tongue.

On looking at a Snake carefully, taking the Common English Spotted Snake as an example, no difficulty is found in distinguishing the head from the rest, and it is evident that there are no limbs, but what is neck, body, and tail is not at first so readily determined. The neck is, of course, the part behind the head, and it merges gradually into the body, there being no place of division; but the tail, although not very distinguishable on the top of the Snake, is so beneath, for it is placed behind the part from which the evacuations come, and its scales are arranged differently to those in front, they being in double rows, whilst all those of the underneath part of the body are in a single row.

With very few exceptions, the Snakes of all the divisions are covered with scales, and there may be plates on the head. The scales are not bony, but are true skin structures, and they are occasionally shed, new ones appearing. The presence of plates on the head, the arrangement and character of the scales on and under the body and tail, their colour and ornamentation, are all useful in the classification of these reptiles, for they are very persistent characters, if the coloration is excepted, for this is often very variable in the same species in the same country. The shape of the head, and the relation of the size of the body and tail, are also important distinctive characters, and the anatomy of the skull, jaws, and teeth is of the greatest value in the primary separation into great groups.

But although there is no difficulty in distinguishing a Viper, a Boa Constrictor, or a Common Snake from any other animal, it must be remembered that there are some Saurians which closely resemble some of the Snakes. *Amphisbæna* (p. 294), and *Anguis* (the Blind-worm), and *Acontias* and *Pseudopus* (pp. 298, 299) are Snake-like and have no limbs. On the other hand, it has been found that such great Snakes as the Boas, for instance, and, indeed, all the species of a Snake family (the *Pythonides*), have minute vestiges of hind limbs, scale-like or spine-like, close to the vent; and this peculiarity recalls to the student the Lizards of the peculiar Australian kind (*Pygopus*), and the Brazilian *Ophiodes*. Moreover, amongst the Amphibia, which have not as yet been considered in this work, there is a Snake-like form called *Cæcilia*. These resemblances are not entirely confined to the outside, for some of the Sauria have one of the lungs ill-developed, the other preponderating, and this is found in all the Snakes. Moreover, although the great majority of the Serpents swallow their food whole, by means of a special mechanism which permits distention of the jaws and throat, some consume such small prey that there is not this gift. And in the absence of this very common characteristic, many of the smaller Colubrine Snakes resemble some of the Snake-like Lizards. But on examining the internal organs, and especially the bony framework of the Snake's body, the distinctness of the order *Ophidia* from that of the Saurians becomes more and more evident. No Snake has a shoulder girdle, and the eyelids, the covering of the tympanum, and the bladder are wanting.

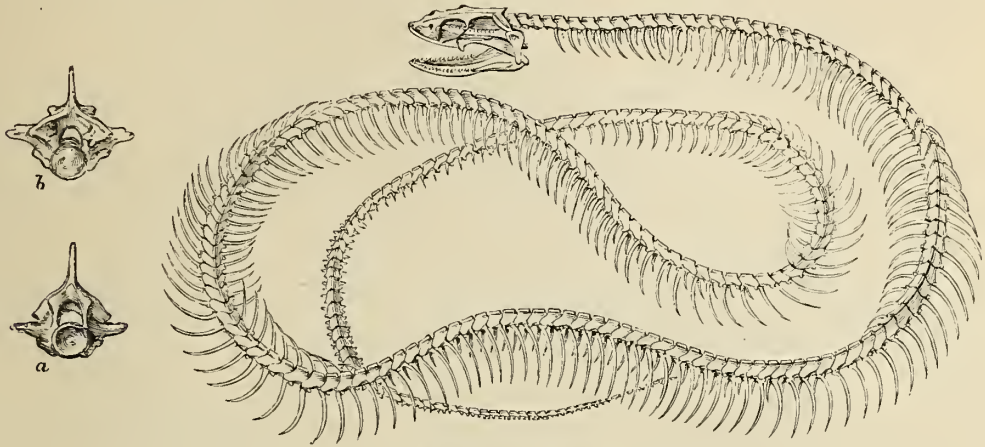
In considering this inability to separate the great groups of Snakes and Lizards by outside characters in some instances, and by some internal ones also, it becomes evident that there is no hard and fast line to be drawn between them. Moreover, study gradually develops the thought that the Snakes, coming late into being in the world's history are, like the limbless Lizards, modifications, by a degenerative process, of reptiles which did not crawl on their belly, but which had those organs in perfection which are rudimentary or absent in the Serpent. Beautiful to look at, glistening often with an iridescence which adds to their mosaic of lovely colours, moving with great grace, apparently with an incomprehensible and determinate will, seizing their prey to crush it and swallow it, or to destroy it by poison in a few minutes, no wonder that early man worshipped these emblems of destruction and death, and gave them credit for wisdom and power.

This belief increased in the days when myths originated, and Serpent worship became as great an institution as that of any other animal, and left its impress on the minds of many generations, thanks to tradition, a peculiar symbolical architecture, and ignorance of natural history. The curative powers of powdered Snakes, of the concretions collecting sometimes in their insides, and of their cast-off skins, were long believed in, and the Serpent became the medical coat-of-arms. Their rapid movements and powers of attack were attributed to the gods, whose messengers of death they often were, and it is therefore not to be wondered at, that during every age when superstition has dominated the Snake was a power. The fascination said to be exercised by Snakes over their prey has formed the subject of many essays, and it is universally credited that under the glance of the Serpent, birds, animals, and even man, are motionless, unable to fly from the glistening evil, and, regardless of danger, do not seek to escape, or fully aware of it, cannot. Snakes in a state of nature and in captivity are different creatures, and the descendants of thousands of generations of animals, all of which have suffered more or less from the Serpent's attack, may have hereditary fear of it. But in the Snake-room of the Zoological Gardens the captive Snakes, and the Rats, Mice, and Birds, unaccustomed to Snakes, do not impress one with the truth of the popular belief. Terror, undoubtedly, may exercise a paralysing influence on the creatures in the way of the Snake; and the parental affection of birds for their young, which causes them to flit about their nest, and to be destroyed with their little ones, is usually but erroneously taken for fascination on the part of the Snake. In fact, an analysis of any instance of fascination shows it to be supposititious.

A Snake when on the ground moves often with considerable rapidity. The head is slightly raised, and the body and tail progress by means of the peculiar grasping power of the skin and ribs of the underneath parts, which enables consecutive contraction and elongation to occur. The movement is more or less flat with the earth, and the Snake never coils upwards, as is often figured in old and some new paintings and engravings. It can erect its head and much of its neck and fore part of the body, and this is also done when the creature is in horizontal coils, and quiescent. On moving up a stone or tree the head, neck, and much of the body may be placed against the more or less vertical object, and a small portion only of the body may be left on the ground, but in this position the Snake is liable to fall sideways. On moving up a tree they do not coil themselves round and round it like a rope, but they may do this when still. It is wonderful how Snakes move along and between boughs, and, taking a turn round one with their tail end, swing and look for food, and also how they will make themselves up into a bunch on a fork of a tree, and remain there without falling. They swim in an undulating manner, but the body is wriggled on the same plane as the surface of the water, and not at right angles to it, but in rushing at their prey, both in the water and on land, there is more or less upward or downward bending of part of the body, and a rapid thrust of the head forwards.

On looking at a skeleton of a Snake, the eye is impressed with the great number of vertebræ and ribs. In some great Pythons more than 400 vertebræ have been counted, and each one is movable on its neighbours. There is little distinction to be made by their structures between the vertebræ of the neck, body, and tail, and there is no sacrum. The first vertebra, or atlas, and the second, which has the odontoid process, resemble those of the Lizards, and the first of these is the only vertebra in front of the tail which has no rib. The body of a vertebra has the joint surfaces before and behind nearly hemispherical, and there is a concavity in front to receive the corresponding ball on the back of the vertebra. Above, the spinous processes under the skin of the back are generally long and flat, and project backwards somewhat, and at the base of each, on either side of the canal for the spinal cord, is a process which fits into a cavity in the next vertebra, after the fashion of the Iguana's vertebra (p. 280). Besides these, there are the ordinary articulating processes of the sides. There are twelve jointing surfaces to each vertebra, and great movement is allowed by the ball-and-socket joint, but dislocation is prevented by the "double tenon" and "double mortice," which parts are called zygantrum and zygosphenæ, as in the Iguana. The transverse processes are very short, and are recognised by a tubercle which offers two facets for articulation with the ribs. But in the tail they are long and inclined downwards. The ribs are, of course, great in number, and each pair is jointed on to the tubercle above mentioned by a ball-and-socket joint, so that an unusual amount of motion, and especially of fore and aft motion, is allowed. There is no sternum, but each rib terminates by a single tapering cartilage, which is attached by muscular connection with the broad scale on the Snake's

belly. It is by the action of the muscles on the ribs and scales that the Snake may be said to walk on the ends of its very movable ribs. There are no traces of a shoulder girdle or of fore limbs in Ophidia; but the Blind Snakes, Rock Snakes, Boas, and Rollers have rudiments of a pelvis, and the

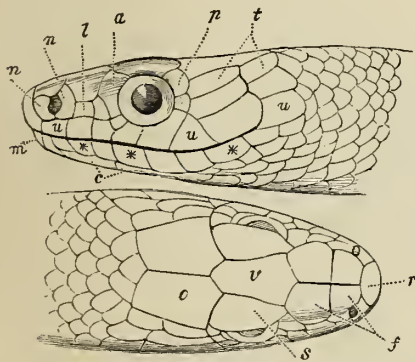


SKELETON OF SNAKE.

(a) Anterior, (b) Posterior, view of Dorsal Vertebra.

last have crooked bones terminated by claws externally. The nature of the skull will be considered in treating of the great groups.

The beautiful scales on the body, and the regular plates and small scales on the heads of Serpents, are various in shape, number, ornamentation, and colouring, and they may or may not be keeled, and they overlap. All are thickened skin, and are covered with a delicate scarf skin. The plates on

SCALES ON HEAD OF SNAKE (*Styas Korros*).

(After Günther.)

(*n*) Rostral; (*f*) Posterior and Anterior Frontal; (*v*) Vertical; (*s*) Superciliary; (*o*) Occipital; (*u n*) Nasals; (*l*) Loreal; (*a*) Anterior Ocular or Orbital (Anteocular or Preorbital); (*p*) Posterior Ocular or Orbital (Postocular or Postorbital); (*u*) Upper Labials; (*t*) Temporals; (*m*) Median Lower Labial or Mental; (**)* Lower Labials; (*c*) Chin shields.

the head are on the same principle as those of Lizards, but there are some others which are peculiar.

The number of rows of scales on the top and sides of the body and tail differs with the genus and species. Usually there is a double row of scales on the under surface of the tail, and the rest of the under surface of the body has a continuous row of single broad scales, which are very striking in appearance, in contradistinction to the others.

At the moulting period the Snake is dull, lethargic, and careless, and the outer scarf skin comes away as a perfect scarf of the body and eyes.

SUB-ORDER THANATOPHIDIA.*—THE POISONOUS COLUBRINE SNAKES.

The venom of a Snake is secreted by a gland on either side of the front part of the skull, and which is close to the maxillary bones that support the long and more or less curved poison fangs. The duct of each gland leads either to a groove in the front part of the fang, or to a canal in the tooth formed by the union of the sides of a groove, and in both instances the liquid poison enters the victim with the tooth, and some is left behind. Those Snakes which have the first fangs of the upper jaw grooved along their front do not differ very much in their shape from the common innocuous Snakes, although some have the power of expanding their neck into a kind of hood; but those which have the hollow teeth are usually distinguishable by their large triangular head, short body, and very short tail, and are viperiform. Thus two great divisions of the poisonous Snakes exist; the first with grooved teeth—the

* θάνατος, death; ὄφις, a serpent.

Proteroglyphia, and the second with canaliculated teeth—the *Solenoglyphia*. The Snakes of the first division or sub-order resemble the common Snakes in their general configuration, and are termed the Poisonous Colubrine Snakes. The second sub-order is often called the Viperine.

The first sub-order is subdivided into two families; in one the Snakes are terrestrial, the *Elapidæ*,* and in the other they are aquatic, the *Hydrophidæ*.

SUB-ORDER PROTEROGLYPHIA.—FAMILY ELAPIDÆ.—THE POISONOUS TERRESTRIAL COLUBRINE SNAKES.

Several genera of Snakes belong to this family, and all have more or less brilliant colours ornamented with lighter colours or red bands, and they may be passed by as innocuous Snakes if they happen to be at rest, and the nature of the jaws and head be not examined. The head is covered with elegant plates, but the loreal is constantly absent, and the muzzle is short, as a rule.† There are large, immovable, grooved teeth placed in front of the maxillary bones, and usually some curved, ungrooved teeth follow; the palate and pterygoid bones, and the mandible, have also curved teeth. A poison gland is developed in relation with the grooved tooth on each side. They are found in all the hot parts of the world except Europe.

GENUS NAJA.—THE COBRAS.

These *Elapidæ* have the power of stretching out some of the anterior ribs and the skin of the neck so as to produce a long hood when irritated. The head is rather quadrangular, and there are one or two small teeth behind the venomous ones. These Snakes can raise the head and much of the body in the erect posture. Among the varieties of the Cobra are those with spectacles on the hood, or “Gokurrahs,” and those with one ocellus or other mark on the hood, named “Keautiahs.”

There is only one species, writes Fayrer, of this genus in India, which is called the Cobra-di-Capello, or *Naja*, and more properly *Naja tripudians*. There is also one species in Western Africa, which is closely allied to the Indian kind, and is called *Naja Haje*. There are several varieties of the Indian species, each having a distinct name given to it by the natives. They are all most deadly. They all have the hood, and they never attack without distending it. They raise the anterior third of the body from the ground, slide slowly along on the posterior two-thirds, and with the hood dilated remain on the alert, darting the head forward to the attack when anything hostile approaches. This attitude is very striking, and few objects are more calculated to inspire awe than a large Cobra, when, with its hood erect, hissing loudly, and eyes glaring, he prepares to strike. Nevertheless, they are not, writes Sir Joseph Fayrer, aggressive; and unless interfered with or irritated, they crawl along the ground with neck undilated, looking not unlike the innocent Snakes, but the moment they are disturbed they assume the menacing attitude.

The *Naja tripudians*, or Cobra, grows to the length of five feet and a half, or even more. One which was given to Sir Joseph Fayrer by Dr. W. B. Beatson was of the variety called “Kurrees Gokurrah,” of a light chocolate colour, without any mark on the hood. It was five feet eight inches long, including the tail, which measured eleven inches and a quarter. In girth it was six inches and a quarter. This is the largest Cobra seen by Sir Joseph Fayrer, but he believes they attain even a greater size than this. The Cobra is found all over Hindostan up to 8,000 feet high in the Himalaya; but Mr. Hodgson says he has never seen it in the Nepal Valley. It is equally dreaded and fatal everywhere. The varieties are numerous, and they are distinguished by the markings on the hood, and by various shades of colour, from the darkest olive or black with a purple iridescence, to a pale chocolate, fawn, or yellow colour. The natives say that the Spectacled Cobra is a Snake of the city or town, and that the Keautiah, or Nág Sáráp, prefers the fields and jungle. But both are common about Calcutta. The Cobra is a nocturnal Snake, that is, it is most active in the night, but it is often seen moving about in the day. It is oviparous, and the eggs, from eighteen to twenty-five in number, are oblate, and about the size of those of a pigeon; the shell is white, but tough and leathery. The Cobras feed on small animals, birds' eggs, frogs, fish, or insects.

* *Elaps*, a kind of Serpent.

† The large scales or plates on the heads of most Snakes are beautifully arranged, and are used in the classification. They are named rostral, anterior frontal, posterior frontal, vertical, superciliary, occipital, nasals, loreal, anterior ocular, posterior ocular, upper labials, temporals, mental, lower labials, and chin shields (see diagram on previous page).



THE EGYPTIAN COBRA, OR NAJA.

They rob hen-roosts and swallow the eggs whole. They prefer taking their food at dusk or in the night. They are said to drink a great deal of water; but it is certain they will live weeks, even months, in captivity without touching food or water. They go into water readily, and swim well, but are essentially terrestrial Snakes. They can climb and occasionally ascend trees in search of food; nevertheless, they have been found swimming. Usually they are found in the roofs of huts, holes in walls, fowl-houses, old ruins, under logs of wood, in cellars, old brick-kilns, and old masonry of stone, brickwork, or mud. Such are the common dwelling-places of these reptiles, and where they are frequently disturbed by men, who, stepping on or inadvertently disturbing and touching them, receive their death-wound. The Cobra is most deadly, and its poison, when thoroughly inoculated by a fresh and vigorous Snake, is quickly fatal. Paralysis of the nerve centres takes place, and death occurs with great rapidity, sometimes in a few minutes, especially where the fangs, having penetrated a vein, inoculate the poison immediately into the venous circulation. The number of deaths caused yearly in India by these Snakes is perfectly appalling. The cases in which recovery occurs are very few. Treatment appears to be of little avail unless it is almost immediate; and then in the case of a genuine bite there is but little hope of saving life.

With regard to the natives, the *muntra*, or spell, is far more potent in their ideas than any drug, and to such they trust when generally bitten. How frequently these fail, the records of any civil station in India will prove; and it is to be feared that the more material remedies of the physician are scarcely more potent for good.

The Cobras are the favourites of the snake-catchers, and it is astonishing with what ease and freedom they are seized and handled by these men even when in possession of their fangs. The snake-catchers render them temporarily harmless by cutting out the poison fangs, but these are quickly reproduced unless, as most generally happens, with the fang all the reserve fangs and germs are removed, in which case the Snake is harmless for life. The Cobra has the power of raising its head, neck, and much of its body for awhile, so that it stands, as it were, on the tail. It moves to and fro from side to side in a very graceful manner. Their elegant movements in the erect attitude which they assume with the hood distended, as they follow the movements of the snake-charmer's hands, make them an object of wonder as well as fear to all, and the superstitions of the natives about them are endless.

Fayrer remarks that the Cobra is an object of superstitious veneration and awe to the Hindoos, in whose mythological histories it takes a prominent place. "In a religion that deprecates the wrath of a cruel and destructive power, by worshipping and propitiating the Deity in whom that power is vested, it is natural that the type of destruction and the incarnation of evil, as represented in this reptile, should be regarded with peculiar deference."

Besides being found on the mainland the Cobra is an inhabitant of the Philippine Islands.

The Egyptian Cobra, or *Naja*,* is the *Aspic* of the ancients. Its figure is sculptured on the portals of many ancient temples, as an emblem of the protecting goddess of the world and faithful guardian of their fields. It was, in the time of the great expedition to Egypt under Napoleon, very common in ditches and fields.

Snake-charmers, the successors and perhaps descendants of the "*psylles antiques*," so celebrated in the writings of Pliny, and rich in the tradition of an art already old before Africa became Christian, say they can change a *Naja* into a stick, and make it counterfeit death. When they desire to produce this result they spit down the Snake's throat, make it shut its mouth, lay it down on the ground, and give it the order, placing the hand at the same time on the head. The Serpent becomes stiff meanwhile, and falls into a kind of catalepsy. They awaken them by rubbing the tail between the hands.

The Cobras of South Africa belong to the species *Naja Haje*, and are the "*Geel Copell*" of the Dutch colonists. They are from three to six feet in length, and are entirely yellow or purplish-brown, both colours sometimes existing in some individuals.

THE RING HALS SLANG.†

This poisonous Snake is often seen in menageries and in zoological gardens, and is remarkable for its glossy dark tints, fine dark brown eye, and for the dull blackish colour of the head

* *Naja Haje*.

† *Naja hamachates* = *Sepedon hamachates*.

and body before the skin-shedding takes place. It has rather a robust body, and the head is scarcely broader than the neck. It is flat above, and the upper lips protrude beyond the edge of the upper surface of the head; hence the eyes appear rather small, giving a malignant and savage expression (Smith). The neck has a quantity of loose skin which forms a fold on each side, and this is extended Cobra-fashion when the creature is enraged, and it is a kind of hood. Probably the extreme length of the Snake is nearly three feet. The range of the Ring Hals Slang is considerable, and specimens have been found everywhere in South Africa. It is very vigilant, and its resting-place can very rarely be approached before it is all activity, either commencing to fly, preparing to maintain its ground, or make an attack. Its holes are in and about mouse, rat, and mole burrows, and although it retreats, it is a valiant and very poisonous Snake. The natives properly consider it the most courageous of all their Snakes, and one of the most poisonous. When in confinement and irritated it evinces great ferocity, opens its mouth so as to be in readiness to seize any object, and the poisonous secretion comes out in drops from the fangs, which are raised and ready to strike.

GENUS OPHIOPHAGUS.—THE HAMADRYAD SNAKE.*

A snake-eating Snake, with a beautifully shielded head and a neck dilatable like a Cobra's is, of course, interesting, and especially when it is known that it grows to the length of fourteen feet, and is bold and disposed to attack, instead of retreating, like the *Naja*.

The body is largely scaled, and the head is short, depressed, and scarcely distinguishable from the neck, which is dilatable. The body scales are smooth, minute, imbricate, and in transverse rows. The plates on the head are very distinct, and the occipitals are surrounded by three pairs of large shields, the two anterior being temporals. The ventral scales are entire, and there are more than two hundred of them, and the posterior sub-caudals are two-rowed. The tail is slender, and becomes very small at the tip. The maxillary bone has a large fang in front, which is perforated at the end, showing a longitudinal groove in front. A second small, simple tooth exists at some distance behind the fang. It is called "Sunkerkhor" by the natives, and has a general resemblance to the *Naja* in shape. The colour varies according to age and locality. The young *Ophiophagus* may be mistaken for a Snake of another genus, such as *Dipsas dendrophila*, an innocent Snake.

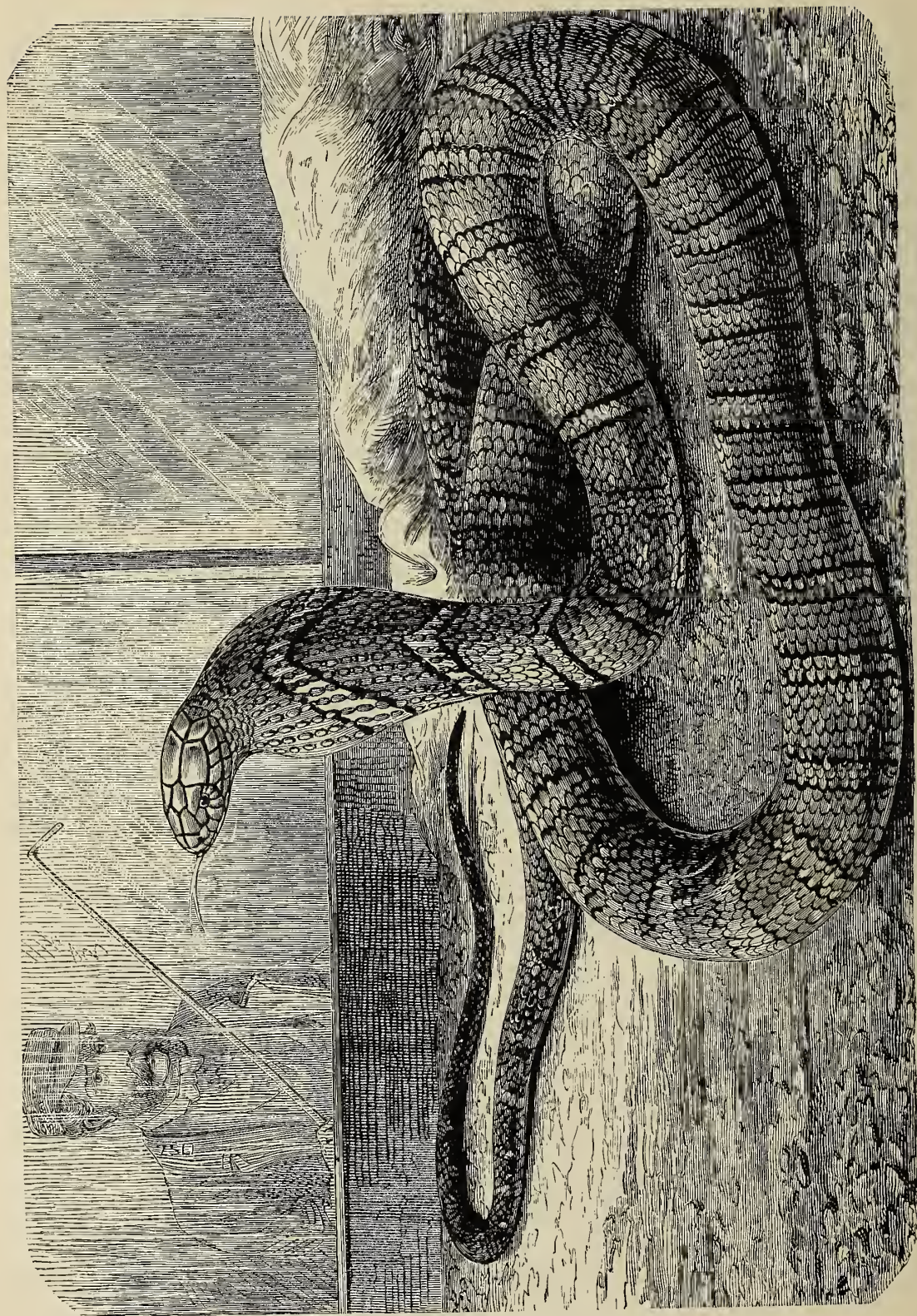
The *Ophiophagus* is probably the largest and most deadly of the Indian Snakes; and, fortunately, though widely distributed, it is not very common. According to Günther, it is found in almost every part of the Indian continent, and in the Andaman and Philippine Islands, in Java, Sumatra, Borneo, and, according to Duméril, in New Guinea. It reaches from twelve to fourteen feet in extreme length, and is common near Cuttack, and there is a dusky variety from Rangoon. It does not appear to be much if at all known in the North-west or in Central India; it is most common in the damp climates of Assam, Bengal, Orissa, and Southern India. It has been caught in the Botanical Gardens, near Calcutta, and it is said by the snake-catchers to be not uncommon in the Sunderbunds, and it takes to water.

The dilatable neck is not altogether peculiar to the Snakes just mentioned, and Fayrer observed that in *Compsosoma radiatum*, an innocent Snake, the neck and much of the whole body dilates vertically when it is excited and about to strike, presenting a very remarkable appearance; but the power of dilating the neck is better marked in the *Najide* than in any other Snake. Another equally innocuous Snake, called *Tropidonotus macrophthalmus*, found in the Himalayas, has the power of dilating the neck, and it greatly resembles the Cobra.

The *Ophiophagus* in the Zoological Gardens of London knows its keeper and feeding-time. When a Snake is put into its cage it is immediately on the alert, and the victim tries to escape. But the attack is commenced at once, and the prey is seized behind the head and dragged on to the floor, and gradually swallowed head first.

Besides the *Ophiophagus*, there is another snake-eating venomous Serpent in India, which lives principally on others belonging to the innocuous Calamaria family. This is a ground Snake, slow in its movements, and it prefers hilly to level country. Singularly enough, it greatly resembles its prey in outward appearance, and belongs to the genus *Callophis*.

* *Ophiophagus elaps*.



THE HAMADRYAD SNAKE.

GENUS BUNGARUS.—THE BUNGARUMS AND KRAITS.

Two kinds of very venomous Snakes, which often reach four feet in length, and which have not the power of enlarging the neck, are found nearly all over India. One can be recognised at once by its ornamentation, which is that of a number of rings alternately steel-blue and bright gamboge-yellow; by its triangular outline, for there is a ridge on the top over the vertebræ, where there is a line of hexagonal scales; and by its hard, blunt, bony end to its tail. It is called the Bungarum Pamah.* It is common in Bengal and in Southern India as well as in Burmah, and its bite is very dangerous. It does not erect its head, but lies coiled up in curves, and, when disturbed, jerks itself out like



BUNGARUS FASCIATUS.

a spring, but without extending its whole length of body. This Snake is not so common as the Cobra, and is rarer than the other kind about to be noticed. No doubt a great fatality accompanies the bite of its small teeth, although the poison is somewhat long in acting.

The other kind is called the Krait, or Gedi Paragoodoo,† and it differs much in colour from the Bungarum. It has the lower part of the body of a uniform white colour, and the upper parts are bluish or brownish-black, uniform or with more or less numerous very narrow white streaks, not quite as broad as a scale, and generally radiating from a white vertebral spot. The tongue is white, and the iris is black. It sometimes insinuates itself into houses, in the verandah, ball-rooms, or the ledges of doors or jhilmils, into bookcases, cupboards, &c., and in such situations is not unfrequently the cause of fatal accidents. Next to the Cobra it is most destructive to life.

Australia has several of these poisonous *Elapidae*, and some are more venomous than others. Thus, the Grey Diemenia‡ produces an irritation like that of the sting of a bee, after its bite, but the Brown Snake§ is very venomous. The Red Capped Snake,|| a common little Snake, is venomous, but does

* *Bungarus fasciatus*.† *Bungarus cœruleus*.‡ *Diemenia psammophis*.§ *Diemenia superciliosa*.|| *Brachysoma diadema*



THE CORAL ELAPS (*Elaps corallinus*).

not seem usually inclined to bite, and is insectivorous, eating also frogs; but the Black Snake, the most common Australian venomous Snake,* a lover of water and marshy places, has many of the actions of a Cobra. Equally fatal is the bite of the Brown-banded Snake,† which frequents the plains. The Death Adder,‡ with very variable colourisation, and loving warmth and sandy places, and assuming the form of the letter S on being irritated, is a very fatal enemy. It has a large head, and the tail ends in a short recurved spine.

The *Elapide* of the New World are usually beautiful Snakes. The Harlequin Snake (*Elaps pulvius*), a small burrowing kind, and the Coral Elaps, from Rio and the Brazils and Central America, are examples.

FAMILY HYDROPHIDÆ.—THE POISONOUS SEA SNAKES.

The members of this family, all of which lead an aquatic life, may be recognised at once by their shape, and some peculiarities which relate to their method of life. The body is comparatively flat at the sides, and the tail is decidedly so, and acts as a propeller and steerer, and the nostrils open upwards and are closed with a valve, the tongue being short. They are all venomous, and inhabit the sea, near land, salt-water estuaries, and tidal streams. They have a very wide range of distribution, being found on the coasts of India, in the Indian and Pacific Oceans, from Madagascar to the Isthmus of Panama, in the Eastern Archipelago, and in the seas between Southern China and North Australia. Some of them attain a considerable size. Günther speaks of some species attaining to the length of twelve feet. The longest seen by Sir J. Fayrer was under five feet, there is no reason to believe that they attain to so great a size as certain fabulous stories would suggest.

They swim like fish, and live, with some exceptions, continually in the sea or tidal water. When thrown on the land by the surf, as they constantly are at Pooree and other places along

* *Pseudechis porphyriacina*.

† *Hoplocephalus curtus*.

‡ *Acanthophis antarcticus*.

the coast, they are helpless and almost blind. Their food consists of fish and other aquatic animals, which they pursue and overtake in the salt water. There are certain parts of the Bay of Bengal in which they are often seen in great numbers, and their movements in the clear blue water are very agile, graceful, and beautiful.

The *Hydrophidæ* generally have no well-marked ventral plates, and the abdominal scales differ little from those of the rest of the body, which are generally hexagonal, laid side by side, occasionally slightly imbricate, and in some tubercular, a small tubercle being found in the centre of each scale. But one genus (*Platurus*) has abdominal scales like the Land Snakes, and is sometimes found in marshy ground near the sea.

The nostrils and head shields of the Sea Snakes are peculiar. The eyes are small, with circular pupils, which contract so much when the Snake is taken out of water that it is said to be almost blind.

They are very poisonous. The case related of a sailor of H.M.S. *Algerine*, who was bitten by one caught at Madras, proves them to be so. Fayrer instances a fisherman who was bitten by a Salt-water Snake somewhere near the Salt Lakes, and who died in one hour and a quarter. The fishermen on the coast know their dangerous properties, and carefully avoid them.

The genera *Hydrophis*, *Pelamis*, *Platurus*, and *Enhydrina* belong to this family.

SUB-ORDER SOLENOGLYPHIA—THE VIPERINE SNAKES.

These poisonous Snakes have the head triangular in shape and enlarged behind, whilst the tail is short in relation to the body. They have a small upper maxillary bone on each side, which has one large, hollow, perforated, erectile fang, and often some others growing to replace it. There are small curved teeth on the lower jaw and palate. Most of these Serpents are viviparous, and they may be divided into two families. The Vipers (the *Viperidæ*) constitute one, and they have a large, broad head, a vertical and long pupil in the eye, and the top of the head is covered with very little plates and scales. The tail is short, and usually there are two rows of plates beneath it. They have the region between the eye and the nostril flat. They are viviparous, and inhabit the Old World and Australia, Africa producing the greatest number of them. Their poison gland communicates with the canal in the tooth, and the venom is usually very destructive. This they appear to know, for having bitten their prey, they leave it, knowing that it will die, and then they prepare to swallow it.

GENUS PELIAS.*—THE ADDER, OR COMMON VIPER.

This is the sole British representative of the family, and is the only poisonous reptile indigenous to the country. It is far more numerous in Scotland than the Common Snake, and it is found now and then, and formerly in abundance, in all parts of England and Wales. Open woodlands, brushwood, dry heaths, and sandy wastes, are its favourite places, and it does not seek, or necessarily live near, water. Found solitary now and then, or with their young, they are discovered intertwined with several of their own species, when hibernating in their retreats. They are not confined, however, to England and Scotland, for they are found in France, Spain, and from Southern Italy to far north in Russia. Ireland has not this poisonous Snake. They are very variable in their colour; some are nearly olive, and others are a rich deep brown or dirty brownish-yellow in their general ground colour. There is a mark between the eyes, and a spot on each side of the hinder part of the head, and a zigzag line running the whole length of the body and tail formed by a series of confluent rhombs, as well as by a row of small triangular spots on either side, and all these are darker than the ground tints. On looking at the head, it is found to be covered with small scales and some plates more or less regularly placed. The head is almost oval, depressed, and it widens behind the ears. The gape of the mouth is great, and there are no teeth in the upper maxillary bones except the poison fangs. There is a row of small teeth on the palatine bone on each side of the palate. The neck is smaller than the back of the head, and the body increases to nearly the middle. It slightly diminishes to the vent, becoming then abruptly smaller, and lessening to the extremity of the tail.

This Snake is probably the *Exis* of Aristotle, and the *Vipera* of Virgil's Third Georgic, and the

* *Pelias berus*.



VIPERS.

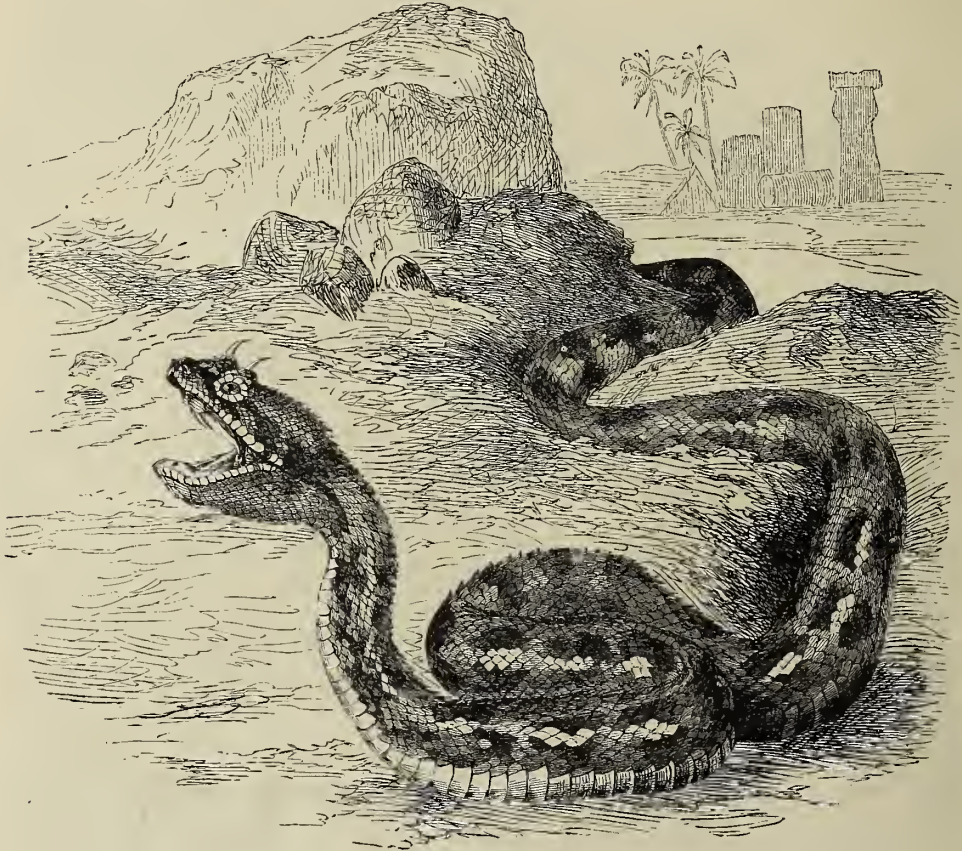
nedre or *eddre*—Adder of the Anglo-Saxons and country people of some parts of England. It avoids man, and when seen basking in the sun will move off on being disturbed: but when injured or brought to bay, it will raise its neck and head and draw back the last a little, and then project it quickly,



THE ADDER, OR COMMON VIPER.

opening the mouth and snapping at the offender. Dogs get bitten by treading on Vipers, or disturbing them, and there are occasional instances of men being bitten. The bites are rarely fatal, but produce much constitutional and local disturbance in unhealthy people, especially in hot weather. Some naturalists suppose that the Viper does not kill its usual prey—mice, small rats, and birds—with its

venom, and only entwines and swallows them, but if the Viper stops a mouse with its teeth, the venom will enter the wound. Formerly Vipers were in demand, for Viper-broth was a remedy, or the Snake might be boiled like a fish, or given as a powder to those patients who suffered from ulcers, or a corrupt state of the system. They were caught in numbers with a cleft or forked stick which the Viper-catchers drove down immediately behind the head. They then seized the creature by the tail, and put it in a bag. Like many other Snakes, Vipers live long without food, and they do not feed well in captivity. They are, of course, viviparous, and the young, sometimes ten or fifteen in number, may be seen with the parent, looking like so many worms with large heads. The eggs are hatched within the Viper,



THE CERASTES VIPER.

and hence it has happened that eggs have been laid and young Vipers hatched from them. Whether the young take refuge in the mouth of the old one, and crawl into her throat in times of danger, or whether they get under her body and glide away, are questions which have provoked much discussion. The young Vipers certainly could get into their parent's mouth, but whether they could get out again is another thing, and therefore it is best to disbelieve this remarkable parental trait in the Viper, of protecting her young in her mouth.

The ancients had a notion that the young Vipers killed their mother in coming into the world, and hence one or more of these parricidal reptiles were placed in a bag with a human parricide and drowned as the punishment of this greatest of crimes.

Another example of the Viper group belongs to those which are more or less "horned." It lives in Hungary, Dalmatia, and Egypt, and has a small, soft horn covered with scales on the muzzle.* The Horned Sand Snake of Egypt, or the Cerastes Viper, which is of a greyish tint, and hides

* *Vipera ammodytes*.

itself in the sand, has a horn above each eye. It is to be seen figured on ancient monuments there.* Dr. Andrew Smith states that there are six kinds of Vipers in South Africa, and that they are mostly indolent, and are heedless of the approach of man. One of them, *Vipera (cerastes) caudalis*, has a slender, recurved head-spine of about a line or a line and a quarter in length, and the tail appears dwindled, so short and tapering is it. It is especially dangerous, for it will not move off, but submits to be trodden on accidentally, and then bites. When once it seizes the obnoxious object, it holds on with great tenacity, and does not rush off when removed. The Horned Viper,† the Hornsman of the Cape colonists, has the eyebrows armed with a clump of lengthened spinous scales



THE PUFF ADDER.

forming a short horn. It has large curved fangs, and swollen upper lips. The Berg Adder‡ of the Dutch colonists and the Puff Adder§ of the Cape colonists are well-known African kinds, and are generally found on the sides of hills or on dry sandy ground. The River Jack Viper|| of the west of Africa is a formidable-looking Snake with a flat head, a longish horn on either side of the snout, a small neck, short body, and thin tail. It puffs itself out when visitors look at it in captivity, and sends forth the inevitable hiss.

The kinds of East Indian Vipers are arranged in two genera—one in which the Snakes have a very large nostril (genus *Daboia*), and the other in which the nostrils are small (genus *Echis*). Sir Joseph Fayrer states that “The *Daboia*, or Russell’s Viper, is called by the natives about Calcutta ‘Uloo Bora,’ from the uloc grass in which it is often found. In Bengal it is called ‘Jessur,’ ‘Siah’-chunder Amaiter.’ It is common in Bengal, and is frequently caught in the Botanic Gardens near Calcutta, also in the South of India, Ceylon, and Burmah.

* *Vipera cerastes*.† *Vipera cornuta*.‡ *Vipera atropos*.§ *Vipera arietans*.|| *Vipera rhinoceros*.

"The *Daboia* is nocturnal in its habits; in confinement it is sluggish, and does not readily strike unless roused and irritated, when it bites with great force and determination. When disturbed it hisses fiercely, and when it strikes, does so with great vigour. Its long, movable fangs are very prominent objects, and with them it is capable of inflicting a very deep as well as poisoned wound. The markings on its body are very beautiful. It lives on small animals, such as rats, mice, and frogs. My snake-man says it will go into water. It is however, terrestrial in its habits. Its loud hissing when disturbed is calculated to warn those who come within its dangerous proximity. It is apparently a hardy reptile, and I had one about forty-four inches in length, which lived a whole year without food or water."

The genus *Echis* contains only one Indian species, *Echis carinata*. The native name is "Afäe" in Delhi. It is unknown to the natives in the neighbourhood of Calcutta.

The *Echis* is very fierce and aggressive, writes Fayrer; it is always on the defensive and ready to attack. It throws itself into a double coil, the folds of which are in perpetual motion, and as they rub against each other they make a loud rustling sound very like hissing. This sound is produced by the rubbing together of three or four outer rolls of carinated scales, which are very prominent, and point downwards at a different angle to the rest. This little Viper can dart a foot or more at its prey, but it does not hiss at all. Its fangs are very long and mobile, like those of the *Daboia*, and its eye has a peculiarly vicious appearance. This active Viper is less than two feet in length.

SUB-FAMILY CROTALIDÆ.—THE RATTLESNAKES, OR PIT VIPERS.

The second group of the Vipers are called "Pit Vipers," and the term is derived from the presence of a little depression on both sides of the face between the eye and the nostril. This is a peculiarity of several genera, some, but not all, of which have species furnished with complete or incomplete "rattles." Most of the Pit Vipers have large heads, which may be completely or not at all covered with large plates. They have the pupil of the eye vertical, and elliptical in shape.

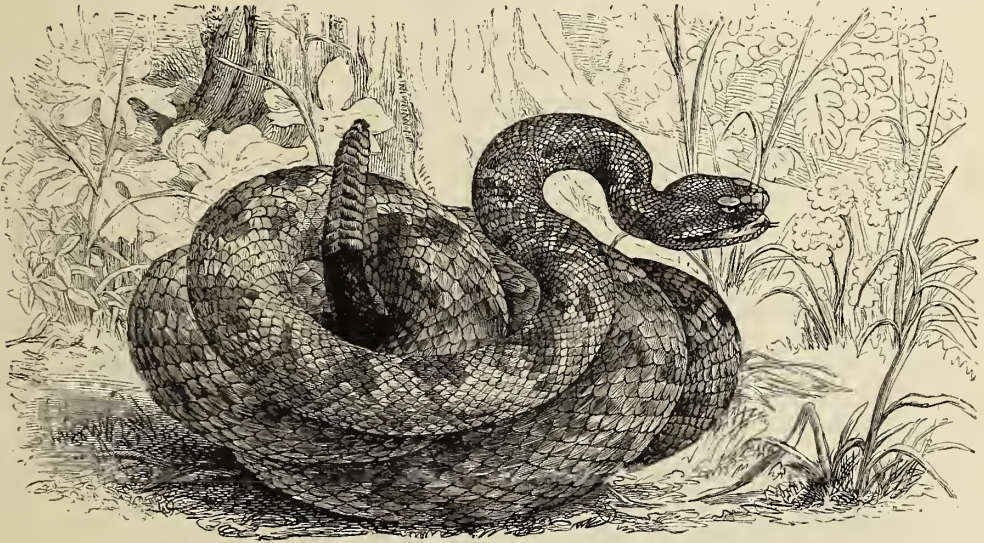
Amongst these very venomous Snakes, all of which have a canal in the poison fangs, the Rattlesnakes are the most interesting. They are readily known by the end of the tail being made up of a number of horny, round, and flat pieces capable of making a sharp sound, not unlike that of a large Grasshopper, by their friction during the vibration of the tail. The head, large behind, is covered there with small ordinary scales, and plates are noticed only in front. They constitute the genus *Crotalus*, and there are several species more or less remarkable for their geographical distribution. The genus is essentially American.

The American herpetologist, Holbrook, thus notices the Common Rattlesnake (*Crotalus durissus*):—The very large head is flattened above, triangular, rounded in front, covered with plates only in front, and with scales on the vertex and back of the head. There is a deep pit between the nostril and eye. The body is long and robust, and is ash colour above, with irregular cross-bars confluent near the tail. The vertebral line is yellow, and the flanks are tinged with the same colour. The tail is short and thick, and furnished with rattles. The nostrils are large and near the snout, but open laterally. The eyes are large and brilliant, and the pupil is dark, oval, and vertical, and the iris is flame-coloured. The neck is much contracted, and its scales are keeled. An average specimen is four feet long and six inches in girth, and the length of the nine rattles is about two inches.

It lives on rabbits, squirrels, rats, &c., and is usually a slow, sluggish, reptile, never wantonly attacking or destroying animals except as food, or unless disturbed by them. A slight touch, however, will effect this, or even the rustling of leaves in the neighbourhood. On these occasions, it coils itself, shaking the rattles violently as a sign of rage, and strikes at whatever is placed within reach. In its native woods one may pass within a few feet of it unmolested. Though aware of the passenger's presence, it either lies quiet or glides away. It never follows, but will slowly retreat, but it is prepared to strike if necessary. It is remarkable that the Rattlesnakes never strike unless coiled, and that if once thrown from that position they can be approached without danger. Years ago they were common enough, but the Hog—which is their great enemy—and man—with his enclosing and tilling of land—have thinned their numbers considerably.

Formerly, and to a certain extent now, this Snake had the widest range of all the American

Crotalidae, being found in nearly all parts of the United States, from lat. 40 on the Mississippi to the Gulf of Mexico. They are now more and more restricted to the south-east. The cuticle on the ends of the tail is arranged in a series of rings, loosely connected together, so as to constitute the rattle. There are many of these rings, according to the species and age of the Snake; but Rattlesnakes grow more than one ring in the year, and therefore the size of this appendage cannot be used in estimating their age. They lose rings and others come, and the greatest known number is probably twenty-one. They are very curious and similar, and the piece immediately connected with the body seems to be moulded on the last vertebra of the tail, from which it is separated by a layer of the true skin by which it is secreted. Its surface presents three circular elevations corresponding to three protuberances. Of these, the first, or that nearest to the body of the reptile, is the largest, and the other two rings are encased in the succeeding piece, which is connected in a



THE COMMON RATTLESNAKE.

similar manner to the next ring, and so on throughout the series. The posterior two-thirds of each ring are thus embraced by the next, so that of the three prominent rings that project from each piece the anterior only is visible, the two posterior being contained in the next ring, with the exception of the ultimate one. Each piece is loose, and plays freely about that which it envelops. There is no muscle, and the noise is produced by a shake of the tail.

Bates testifies to the slowness of the attack of other species of Rattlesnakes. When on the Lower Amazons he saw a Rattlesnake for the first time. He heard a pattering noise close to him, and thought some creepers on a tree were about to fall; but when the wind lulled, it was evident that the noise came from the ground. On turning his head to look, a sudden plunge startled him, and a heavy gliding motion betrayed a large Serpent making off from beneath his feet. This was a Rattlesnake. Again, his little dog Diamante rushed one day into a thicket and made a dead set at a large Snake, whose head he saw above the herbage. The foolish little brute approached quite close, and then the Serpent reared its tail slightly in a horizontal position and shook the terrible rattles. It was many minutes before Bates could get the dog away.

The Water-rattle* is seen in damp and shady places, and abounds in East Florida, the Gulf States, and Mexico, and reaches eight feet in length, and its dusky colour, bloated body, and grey and yellow iris, give it an expression of sullen ferocity. It is also called the Diamond Rattlesnake.

Central America and Brazil have the "Horrid Rattlesnake,"† which is a most widely dispersed species of Eastern North America. It has a black band across the forehead, and another

* *Crotalus adamanteus*, or *rhombifer*.

† *Crotalus horridus*.

from the eye to the angle of the mouth. There are two large black bands which begin behind the head and run along the neck and back for some distance. The nasal plates are very small, and the space between the orbits is covered with plates or scales, larger than those in the others.

The Missouri Rattlesnake* is slim, and is from two to three feet long. They inhabit the country bordering on the Rocky Mountains, and from the Mexican to the British boundaries. It is found from California to Utah, but the Yellowstone is its favourite locality. *Crotalus lucifer* is found in Arizona and in the Pacific region.

The Prairie Rattlesnake, or Massasauga,† is distributed in the Prairie countries from Ohio and Michigan westward, and it does not appear to go farther westward than the Yellowstone. They



THE HORRID RATTLESNAKE.

prefer an unproductive soil, where their sluggish gait may not meet the opposing obstacles of grass and mud; and for their hiding-places they seek the holes of the Prairie Dog (*Cynomys Ludoviciana*). It has some large plates on the head, and the rattle is much smaller than in the other Rattlesnakes, and is included in the genus *Crotalophorus* (Gray). There is also a small species in the south,‡ which hides in grass and feeds on field mice.

Coues, the American naturalist, thus writes about the rattle:—"The purpose subserved in the economy of the animal by this singular organ has been the subject of much speculation and discussion. It is difficult to perceive what use the rattle can be, either in procuring prey or avoiding enemies. We do not know that it comes into play at all in the pursuit of prey, while the actual result of its use as a menace in self-defence is the reverse of beneficial to the Serpent, since the sound serves to direct and provoke attack from all enemies which the animal has occasion to fear."

"The principal enemies of the Rattlesnake besides man are hogs, peccaries, and deer. The former

* *Crotalus confluentus* (Say)=*C. Lecontei*.

† *Crotalophorus tergeminus* (Say).

‡ *Crotalophorus miliarius*.

kill the Serpent when coiled, by striking with the hoofs and teeth, and in some regions derive no small part of their subsistence from this source. The popular belief that the venom of the Rattlesnake is innocuous to hogs is merely a partial statement of the fact that the fluid usually fails to enter the circulation through the layer of adipose tissue with which these animals are commonly covered. The venom is conceded to be innocuous when introduced to the stomach, and the flesh of the Rattlesnake is as edible as that of other Serpents. The fatality of the Rattlesnake's bite is by no means the constant element generally supposed, but the result may vary from the slightest amount of poisoning to one rapidly fatal."

"There seems to be a special and peculiar enmity existing between the Rattlesnake and Moccasin Snake, and the Black Snake (*Bascanium constrictor*) and the 'King Snake' (*Ophibolus getulus*, *Sayi*); these last two species waging a constant warfare against the former, and invariably conquering, according to information received from reliable parties. After the conflict, the vanquished is eaten by the victor. In one case reported, a large Black Snake had seized a Rattlesnake and entwined two or more folds behind his head, and several six or eight inches farther back; then by muscular effort had torn the body. It is a well-known fact that both Rattlesnakes and Moccasins will endeavour to get away from the 'King Snake,' and in the South this beautiful and harmless species is protected in view of this fact."

In Surinam, Guiana, and the Brazils there is a fine Snake called the Bushmaster,* which grows to more than six feet in length, and it is interesting from having many of the habits of the true Rattlesnakes, and a rudiment of a rattle. The structures at the end of the tail consist of ten or twelve rows of spiral scales which are slightly recurved or hooked at their summits. It does not climb trees, but frequents underwood near the rivers, and is well known for its venomous powers. The natives call it "Surukuku."

Some of the Pit Vipers have a large plate on the top of the head instead of the small scales of the genus *Crotalus*, and are included in the genus *Trigonocephalus*, and Charles Darwin notices one in his usual inimitable manner, at Bahia Blanca:—

"Of reptiles there are many kinds; one Snake (a *Trigonocephalus*, or more properly a *Cophias*), from the size of the poison channel in its fangs, must be very deadly. Cuvier, in opposition to some other naturalists, makes this a sub-genus of the Rattlesnake, and intermediate between it and the Viper. In confirmation of this opinion, I observed a fact, which appears to me very curious and instructive, as showing how every character, even though it may be in some degree independent of structure, has a tendency to vary by slow degrees. The extremity of the tail of this Snake is terminated by a point, which is very slightly enlarged, and as the animal glided along it constantly vibrated the last inch; and this part striking against the dry grass and brushwood, produced a rattling noise which could be distinctly heard at the distance of six feet. As often as the animal was irritated and surprised, its tail was shaken, and the vibrations were extremely rapid. Even as long as the body retained its irritability a tendency to this habitual movement was evident. This *Trigonocephalus* has, therefore, in some respects the structure of Vipers, with the habits of a *Crotalus*; the noise, however, being produced by a simpler device. The expression of the Snake's face was hideous and fierce; the pupil consisted of a vertical slit in a mottled and coppery iris; the jaws were broad at the base, and the nose terminated in a triangular projection. I do not think I ever saw anything more ugly, excepting, perhaps, in some of the Vampire Bats. I imagine this repulsive aspect originates from the features being placed in position, with respect to each other, somewhat proportional to those of the human face, and thus we obtain a scale of beauty."

North Carolina and to the south, and across to the Rocky Mountains, seems to be the country where a fish-eating Snake,† with a large plate on its vertex, and a pointed rattle-less tail, is found. It is usually called the Water Viper. The Copper-head Snake,‡ often wrongly called the Moccasin Snake, belongs to this group also, and preys upon frogs and birds, and probably fishes. It has a bad character amongst the inhabitants of the United States south of the forty-fifth parallel of latitude.

The last group of the American Pit Vipers is that of the Lance Snakes. One of these is the Yellow Viper, of Martinique,§ called Fer-de-Lance there, and the Rat-tailed Serpent, at St.

* *Lachesis mutus*.

‡ *Trigonocephalus (Ancistrodon) contortrix*.

† *Cenchrus piscivorus*.

§ *Bothrops lanceolatus*.

Lucia, in the West Indies. Other and very venomous Serpents of the group live on the mainland, and the principal are *Jararaca** and *Bothrops atrox*.

Halys is the only East Indian genus of Pit Vipers or Crotalidæ with a vestige of the rattle, and it is reduced to a simple horny spine at the end of the tail. Many of these Indian *Crotalidæ*, such as the *Trimeresurids*, are arboreal Snakes, and in colour resemble the foliage or branches of the trees in which they live. These *Trimeresuri* are said to be naturally sluggish,



THE COPPER-HEAD SNAKE (*Ancistrodon contortrix*).

and are apt to lie quietly, hidden by the leaves or branches they resemble in colour, until disturbed; then they are sometimes fierce and aggressive, bite savagely, and make a hissing sound as they prepare to strike, which they do by first drawing back the head and anterior part of the body, and then darting it forward with great rapidity. Their tail is prehensile.

The venomous Snakes kill by inoculating their victim with a liquid poison, which escapes by a groove in front of the fang, or by a canal formed by the cohesion of the edges of the groove. After depriving their prey of the power of escape and resistance, they proceed to swallow it. On the other hand, the non-venomous Snakes stop, and wound, and often kill with their well-developed solid teeth,

* *Craspedocephalus* (*Bothrops*) *Brasilensis*.

and then commence the extraordinary swallowing, having often enveloped their prey in the folds of their body, crushing it more or less.

In the first group a special adaptation of the usual bones of the head enables the contents of the poison-gland—probably an altered and adapted salivary gland—to be injected, and there are remarkable movements permitted, which enable the Snake to bite and to protect its fangs from subsequent injury. Then in the act of swallowing, a peculiar mobility and separability of the jaws and associated bones come into play, and this is, of course, noticed also in the second group. In endeavouring to explain



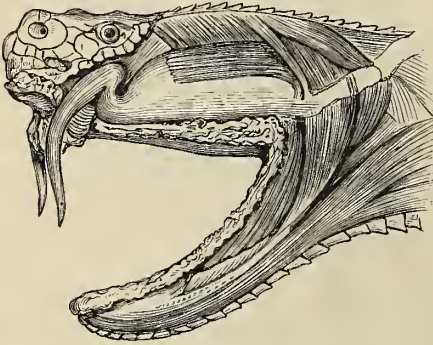
THE YELLOW VIPER, OR FER DE LANCE.

these necessary actions and movements it must be noticed, first of all, that whilst the bones which enclose the brain of the Snake are solidly united, those of the face, upper and lower jaws, and palate, and those which joint the lower jaw with the skull—the lower jaw with the quadrate, and this with the squamosal—are loose and more or less inter-connected by fibrous tissue, permitting of much separation and movement (see Note, p. 275). The movements and special adaptations are of two kinds, those relating to the striking with the poison fang, and those which refer to the forcing back the prey into the mouth and the expansion of the jaws sideways, in order that a huge morsel should pass into a dilatable throat. The first will be now explained, and the last will be noticed farther on.

The Rattlesnakes have been carefully studied, and they may be taken as the type of the venomous Snakes, so far as the construction of the skull is concerned.

The pre-maxillary bones are very small and toothless. The maxillary bone has not the elongate shape of that of the non-poisonous Snake, but it is short, somewhat bag-like, and hollow, and a long curved fang is on that part of it which resembles the bottom of the bag, and which, in the position of rest, looks backwards along the palate. Hence, when quiet, the fang is hidden in folds of the soft tissues of the roof of the mouth. The hollow of the bone is below the pit in front of the eye. The upper and inner part of the maxilla is jointed with a pulley-like surface on the lachrymal bone, so that the bag-like maxilla and its tooth can move forwards and backwards on the lachrymal bone, the end of the fang describing about a quarter of a circle, and being vertical when at the fullest forward movement—in the striking position. The lachrymal bone has some movement on the frontal bone. Now, the mechanism of the bones of the palate and of the side of the head has to produce a forward and backward movement of the free end of the maxillary bone; and it has especial connection with the necessity of the fang being vertical and ready to strike when the mouth is widely open, and of the curving back of the fang along the palate, out of harm's way, when the mouth is shut.

The fang, and its supporting bone hinged on to the lachrymal bone, can be pushed forward as the mouth opens in the following manner:—There are three bones on each side of the mouth whose names are already very familiar, and they are, a small palate bone armed with curved teeth; a long, flat, bar-like, transverse bone, and the pterygoid bone, which is long and stout, and as usual is united behind with the quadrate bone close to the lower jaw. The transverse bone is attached in front by a hinge-like joint with the maxilla, and behind it is connected with the pterygoid. The palate bone is also attached to the pterygoid by a joint, and is connected by fibrous tissues with the skull. These bones form a long line, and as a whole they are in contact with the quadrate bone behind, and with the upper edge of the hinder part of the tooth-bearing maxilla in front. The quadrate bone and the maxilla being movable on the skull, the motion of the first is conveyed to the latter fang-bearing bone by means of the intermediate rod. Now,



HEAD OF RATTLESNAKE, SHOWING FANGS, AND MUSCLES OF POISON GLANDS.

when the mouth is shut, the quadrate bone is placed so that it reaches out from the squamosal bone, on the side of the skull, downwards and backwards, and the pterygoid bone with its prolongation, the transverse, is pulled backwards. So that the hinder part of the maxilla is pulled backwards, and the fang rests on the mucous membrane of the palate. When the Snake opens its mouth to strike, the lower jaw separates from the upper, and the quadrate bone is pushed forward at its end at the lower jaw. This movement acts on the line of bones; the pterygoid is pushed forwards, and the transverse also, so that a force acts on the maxilla tending to press it forward, and to make its lower or toothed part move in a corresponding direction on the joint with the lachrymal bone. This peculiar movement is the result of the combined movements of the transverse and palatine bones and their joint or union with the pterygoid.

The next proceeding is the snap or attempted closure of the jaws on the prey, and the same muscle (or rather part of it) which closes the lower jaw on the upper compresses the poison gland, which lies between it and the side of the skull above and behind the maxilla, and forces a drop of its secretion down its duct which leads into the canal of the tooth. As soon as this is done the mouth is closed, and the long bones pull on the maxilla and restore the fang to its place on the palate.

In the Zoological Gardens in the Regent's Park, London, the Rattlesnakes may be seen exercising, as it were, their jaws, before the Guinea-pig, a favourite prey, is given them. They open the mouth widely, and immediately the long, slightly-curved, slender fangs project well in front, and are at right angles with the upper jaw. It appears as if each slipped out of an envelope of soft skin which never quite leaves their base, or where they are attached to the maxillary bones. Then the mouth is shut and the teeth are retracted during that operation.

It is evident that by its will the Snake can move its maxillæ and fangs, and that when it has killed and begins to swallow by opening its mouth, which is pressed on the victim, the poison teeth are not struck forth. Hence, although opening the mouth is necessary to the protrusion of the fangs, as noticed above, still there are muscular actions required within the sphere of the will. A muscle called the spheno-ptyergoid contracts when the rod of bones is desired to be pushed forwards, and the folding back of the maxilla and tooth is produced by the contraction of the ectopterygoid and spheno-palatine muscles.

The fangs are often cast or shed, and they are delicate, tubular, sometimes half an inch in length, sharp at the free end, and on the whole rather scythe-shaped. The microscope shows that the canal is not a simple passage through the midst of a solid tooth, but that the tooth may be considered flat and to consist of dentine within and enamel all round, and to have been bent so as to form a groove, and finally, by union of its edges, a canal. The poison looks like limpid syrup.

The symptoms of poisoning point to exhaustion and paralysis of the nervous centres, and to a rapid failing of every function of the body. Local paralysis of the bitten part, blood spreading in the skin near the wound, faintness, vomiting, bleeding, and mucous, bloody, involuntary motions precede loss of consciousness, and convulsions close the sad scene. The examination after death reveals but little, and Sir Joseph Fayrer states that in animals the blood nearly always coagulates firmly on removal from the body, and there appears to be some doubt about the condition of that fluid in man, which is said to become uncoagulable and altered in its microscopic characters. The poison acts with most vigour on warm-blooded animals, and especially on birds, for a vigorous Snake bite will destroy a fowl in a few moments. Cold-blooded animals succumb less rapidly, and all die if bitten decidedly; but the poisonous Snakes are not affected by their own poison, or of that of their kind. How the poison kills is a matter of doubt. Dr. Holford believes that the molecules of the poison speedily grow into cells, and that these multiply rapidly, and extinguish, by their capacity for absorbing oxygen, the animal heat and powers. But they have not been seen before death by himself or Sir J. Fayrer, and what was seen after death may have been the result of changes in the last hours, and subsequently. In some cases there is not time for this change, and the poison is as rapid in its action as prussic acid, and is an equally incomprehensible agent of destruction. After a while, symptoms of blood poisoning come on, and should the patient last, the death of portions of the body and of the blood is evident. But the primary action is unknown. The poison being very readily and rapidly absorbed into the circulation, the only chance of successfully treating a bite, by any of the venomous Snakes in hot climates, is to stop its passage by the veins to the heart as quickly as possible. A ligature should be applied immediately above the bite, that is, between it and the body, if on a limb. The natives of India apply one or more, not only just above the bite, but up the limb in several places. A garter, brace, piece of cloth, or anything that can be tied round quickly and strongly, will do. It must be tightened to the *utmost*, and a stick should be put in the strap or string, and twisted. The part soon becomes livid from the arrested blood. Then, if no surgeon is near, have a burning piece of wood placed to the wound, or a live coal, or flash gunpowder on it. A red-hot iron, caustic, or carbolic acid will be still better. Amputate if you are wise, and the patient will submit. Should the bite be where a ligature cannot be applied, a knife must be got out, and the flesh mercilessly cut out at once. Suction is dangerous; cupping glasses are rarely at hand. It is not right to pin one's faith on liquor ammoniæ, for it is not an antidote. If the poison has been absorbed the pulse falls, and prostration commences. Then stimulants are the only hope—ether, brandy, ammonia in water, mustard to the pit of the stomach, and quietude. The patient is in danger of sinking from nervous exhaustion, and, therefore, all the barbarous plans of walking about, flogging, &c., are worse than useless. Every country has its antidotes, and every practitioner believes in one or more, but scientific experiment under Fayrer and Brunton has shown that there is no proper antidote. Certainly, in less venomous Snake bites, such as those of the Australian Snakes, Dr. Holford has had success in injecting Ammonia into the veins.

The venomous Serpents being individually very numerous in India, and the population being dense, it is reasonable to expect that great mortality would occur from Snake bites every year. In 1878, 16,777 deaths occurred from Snake bites, and this awful mortality was not compensated by the death of 127,295 Snakes.

The snake-charmers, Fayrer states, handle poisonous Snakes freely, and without fear, even when in possession of their fangs. The Cobras are their favourites, and occasionally the Ophiophagus, as these Snakes present a very striking appearance when they erect their heads and dilate their hoods. Those they exhibit generally have their fangs removed. This is done by cutting out their teeth, and with them the mucous capsule with the reserve fangs. They are exceedingly dexterous, and the sleight of hand with which they appear to catch a Snake in any patch of grass, or even from the ground, is such as to deceive the closest observer. The Snake is, of course, concealed about the person, but is with great rapidity and dexterity placed in the secluded spot, and as quickly abstracted. They are well aware of the danger, and know perfectly well that no antidote has any effect, though they pretend to prevent or cure bites by roots and snake-stones. With venomous they exhibit innocent Snakes, and their exhibition is always accompanied by the music of a rude pipe made of a gourd.

SUB-ORDER COLUBRIFORMES.—THE INNOCUOUS COLUBRIFORM SNAKES.

This great sub-order includes the non-poisonous Snakes, whose jaws are armed with numerous solid, curved teeth. The body is clothed with rows of large scales, and the head has plates. Their negative character is the absence of a decided venom gland. Nevertheless, it is found that in some the last tooth of the upper maxilla is grooved, and may have a small special, but not necessarily venomous gland. Or no gland may be present. In two families, the Rough Tails and the Rollers, the jaws are not extensible, and the prey is small, but in the rest there is much movement possible amongst the bones of the face and side of the head. There are many families of them.

FAMILY ACROCHORDIDÆ.—THE WART SNAKES.

These Snakes from Japan and British India are peculiar, for the body and head are covered with small wart-like tubercular or spiny scales, which do not overlap. The tail is short and prehensile; the eye is small; the nostrils are close together at the top of the snout; and the short teeth are strong and unequal in size on the jaws and palate. They are viviparous Snakes.

One of them,* found in Japan and in Singapore, is very rare. Its habits are terrestrial. Carter compares its head to that of a bull-dog, and a female in his possession brought forth twenty-seven young ones, all alive and anxious to bite. Undigested fruit has been found in the stomach, but the Snake looks as if it fed on prey.

Another species is aquatic, and has a broad compressed tail. It is not venomous, and lives in the rivers and shallow seas of the Indian Archipelago.†

FAMILY DRYIOPHIDÆ.—THE WHIP SNAKES.

These can usually be readily distinguished by their excessively slender back and tail, the head being narrow and long, ending in a protruding rostral shield, or sometimes in a flexible end to the snout. The scales are narrow and overlap much, and the species have the hinder tooth grooved. The body has been compared to the thong of a whip. They are usually of a green colour, and the Asiatic kinds have a horizontal pupil, and prey by night. They move with great grace in the trees, but awkwardly on the ground. Whilst on a branch they can retain their hold with a few coils of the tail, and then their long bodies shoot forth to seize the birds and lizards which for the most part form their food. Some attain a length of seven to ten feet. An Indian Snake (*Passerita mycterizans*) feeds on birds and lizards, and has a long and more or less movable snout. *Oxybelis fulgidus*, from South America, has also this appendage. An offshoot of this family has species which are also nocturnal, with a short broad head, short snout, and vertical pupil. These are the Dipsadidæ, and they are found in India, Africa, and Australia. They live on warm-blooded animals, some attacking birds only, and others mammals. Their colours are more varied than the common Tree Snakes. The Brown Tree Snake is a type, and is found in Eastern Australia, and it is nocturnal in its habits, preying on birds and eggs.‡ The Ularburong of the Malays (*Dipsas dendrophila*) is one of them.

Some other Indian and African Snakes have a body of a moderate length, and a flat muzzle, the small eye having a vertical pupil. They§ are ground Snakes, and those of India live

* *Acrochordus Javanicus*.

† *Chersydrus granulatus*.

‡ *Dipsas fusca*.

§ Family *Lycodontidæ*.

on Skinks exclusively, whilst the African kinds devour mice and some other small nocturnal mammals.

Some remarkable Snakes come from Madagascar, and have a long fleshy prolongation to the muzzle at least one-third the length of the head. In one species this appendage is toothed, and in the other it is plain. In the Langaha this growth has the shape of a blade, and is sharp at its end. The colour of the Snake is bright brownish-red; and in the Cockscorn Langaha, the muzzle is dentated, the Snake being brown and yellow. They belong to the genus *Xiphorhynchus*. The family is represented in Australia.



OXYBELIS FULGIDUS.

A curious Snake of a purplish colour, densely marbled and mottled with brown, with small rose-coloured spots, the cheeks and lips being carnation, has a flat head resembling that of a mastiff in shape. The lips are arched and tumid. It climbs with ease, and frequents, by night, the roofs of the huts of the natives of Java and Borneo, in searching for food, which consists of insects. It attains the length of three feet. This Snake has a slender body, and tail, which is prehensile, but the head is thick and large, and hence it is the type of the Blunt-headed family. They have a very narrow mouth, and the maxillary bone is very short, and is provided with a few small teeth, and the palate and lower jaw have strong teeth in front, but none are grooved.*

* Family *Amblycephalidae* (Blunt-head Snakes). The species is *Amblycephalus Boa*.

FAMILY DENDROPHIDÆ.—THE TREE SNAKES.

These Snakes are diurnal in their habits, living in trees, and are extremely active climbers and movers amongst the boughs, and their colours, often vivid, assimilate with the surrounding foliage. They are found in all the tropical regions, and feed principally on Tree Lizards. The body and tail are much compressed, or are very slender and elongate, and the head is distinct from the neck, and has a longish snout and wide gape.

FAMILY PSAMMOPHIDÆ.—THE DESERT SNAKES.

These have a longish body and tail, sometimes stout and rounded, and the head, very distinct from the neck, is narrow or thick, and the loreal region is very concave. The scales are smooth, the nostril



DIPSAS DENDROPHILA.

is lateral, and the eye is of moderate size. One of the four or five anterior maxillary teeth is longer than the others, and the last is grooved. They are more common in tropical Africa than elsewhere, and some are slender, others being stout. They frequent plains, and live on the ground. There is one Indian species,* and it reaches forty inches in length. Mr. Jerdon noticed one which had killed and was swallowing a small *Vipera Echis*, and remarks that this is, perhaps, the only instance ever heard of in which a non-venomous Snake overpowered a venomous species. Another, belonging

* *Psammophis condanarus*.

to a second genus,* is very repulsive in its aspect ; and its swollen lips, covered by large hidden fangs, give it the appearance of a venomous Snake. It has a wide geographical range in the Himalayas, and the mainland to China, and in the great islands.

THE RACHIODONT FAMILY.

An egg-swallowing Snake is found in South Africa,† and there are several other species of its genus which probably do the same, and have a peculiar structural arrangement in relation to this food. Dr. Smith writes :—"The paucity and smallness of the teeth in the mouth are favourable to the passage of the egg, and permit it to progress without injury ; whereas, were they otherwise, many eggs which have thin shells would be broken before they entered the gullet, and the animal, in consequence, would be deprived of its natural food when within its reach. Having observed that living specimens which I kept in confinement always retained the eggs stationary about two inches behind the head, and while in that position made great efforts to crush it, I killed one, and found the *gular* teeth about the place where the egg ceases to descend." Those teeth assist in fixing the egg, and also in breaking the shell as the muscles contract around the throat. The instant the egg is broken the shell is ejected from the mouth, and the fluid contents are carried down to the stomach. The so-called *gular* teeth are really the tips of the long inferior spines of eight or nine of the first vertebræ. Their tips are covered with an enamel-like substance which projects through the coats of the gullet, or œsophagus, into its cavity. This is one of the most striking instances of a "final cause" in nature, and the case stands isolated.

There is a family of Fresh-water Snakes‡ which, Günther notices, may be recognised by the position of the nostrils *on the top of the snout*, which enables them to breathe by raising but a very small part of the head out of the water. It is the same arrangement as that seen in the Sea Snakes. There are several genera, and the species are usually small in size. They range widely in British India and the islands of the mainland of Asia. The species *Hipistes hydrinus* greatly resembles a true *Hydrophis* (p. 310). It lives in the sea, but it is not a venomous kind. The Long-nosed Herpeton, a Fresh-water Snake, is remarkable for having two flexible "feelers," which are as long as its snout. They are probably of use when the Snake is under water. It is found only in the southern parts of Siam.

FAMILY COLUBRIDÆ.—THE COLUBRIDES.

This is a very large family, and the following is a general description of the Snakes which form its numerous sub-families and genera :—The head is distinct from the neck, not very large, and plated. The teeth are numerous, and those of the upper jaw diminish in size from before backwards. The tail has a double row of scales beneath, and there are no vestiges of limbs, nor is the body rigid as in the next family. This important family is subdivided, and contains several sub-families, of which the Smooth Snakes of Europe, the Common English Snake, and *Æsculapius* Snake, are types, and they are the *Coronellinæ*, *Natricinæ*, *Colubrinæ*, and *Dryadinæ*. The family is very widely diffused.

SUB-FAMILY NATRICINÆ.

There is a common Snake,§ which frequents many parts of England, and especially places where water is readily reached. By no means uncommon, they are nevertheless rarely seen except by those people who look for them, and, indeed, many of the unobservant live in counties where the Snake is excessively common, and yet never see a specimen. As this Snake is very fond of the water, and swims with ease, and frequents ponds where there are frogs to be caught, it is often called the Water-Snake. It is a slender reptile, with the back part of the head broader than the neck, and the head is rather flattened and ovate in shape. The plates are broad and flat, and there are seven labials. The body is very long, and the middle line of the back is elevated ; the tail is tapering and about one-fifth of the entire length. The scales of the back are oval, imbricated, and each has a keel ; those of the sides are broader and less keeled. The abdominal plates are broad, and number 170, whilst the sub-caudals are in pairs from sixty to sixty-five in number. The upper parts of the body and head are of a light brownish-grey with a green tinge, sometimes approaching to a dull pale olive. Behind the head, on the upper part, is a broad collar, or two curved spots of a bright yellow

* *Psammodynastes*.

† *Dasypeltis scaber*.

‡ *Homalopsis*.

§ *Tropidonotus natrix* (Kuhl) ; or, *Natrix torquata* (Ray).

colour, and immediately behind these are two broad cross spots of black, or they may be confluent. Two rows of small black spots are arranged alternately down the back, and there are larger ones at the sides, all of which vary in size and closeness. The under part is of a pale blue, dull in colour, or it may be of a lead tint marked with black. It is therefore a pretty slim Snake, which may attain to the length of three or four feet. It has a large mouth, and the gape is of the length of the head, and slightly curved, rising behind. The tongue is long, very flexible, and forked to about one-third of its length. The teeth are small, curved backwards, and arranged, as is usual in the group to which this genus belongs, in two series on each side of the jaw above and below.

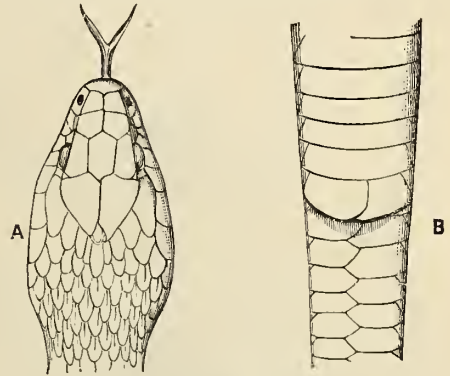


THE COMMON, OR RINGED SNAKE.

They like the warm, sunny banks and heaths where the grass is high, near a pond, and bask by the hour together. They slide down a crack, or move rapidly through the underwood, on an alarm. In the water they are very active, and chase frogs and catch small fish; out of that element they are not very particular in their food, and they will strike and swallow young birds, birds' eggs, mice, lizards, and frogs. The female is larger than the male, and she is oviparous, laying eggs a considerable time before the young ones are hatched. They are deposited in a warm place, and are from sixteen to twenty in number, being connected together by a glutinous substance. Towards the end of autumn, or earlier, they resort to some sequestered and sheltered place, as in the hollow roots of trees or under hedges and brushwood, coil up in company with others, and sleep during the winter, hibernating thus until the warmth of spring is pronounced enough. Mr. Bell, in his work on "British Reptiles," says that the Common Snake is easily tamed, and may be made to distinguish the people who caress and feed it.

When hungry, this Snake moves with great rapidity after its favourite prey, and the frog leaps away quickly enough at first, but soon gives up the struggle. It may seize the frog by the hind leg or quarter, and Bell says that the victim stretches itself out convulsively before it is slowly enclosed within the jaws and gradually swallowed. Sometimes the frog is taken by the Snake so that it leaves three limbs out of the mouth, after the body has disappeared, but they gradually move in and down, and the body of the Snake becomes so much the larger as the food moves into the stomach. The author just quoted once saw a frog which had been swallowed by an unusually large Snake, leap out of the mouth of the latter which happened to gape, as they frequently do immediately after taking food. And on another occasion he heard a frog croaking several minutes after it had been swallowed. In taking lizards and birds the Snake swallows them head first. After a meal the Snake remains inactive for many days, and does not seek a fresh meal until the former one has digested. This Snake is, of course, not venomous, and its little bite does no harm to man or child. They change their skins twice or more in the summer, according to the temperature of the air, and the rapidity of growth. This Snake is found in most of the countries of Europe, from Scotland and the corresponding latitude of the Continent to Italy and Sicily. Mr. Bell says that not only is the Common Snake not a native of Ireland, but attempts to introduce it have failed, not from any peculiarity of the climate, or any sacredness of the beautiful green island, but rather to the prejudices of the inhabitants, which lead to their destruction directly they are introduced artificially.

The genus has an immense range, and the Mocassin Snake, Garter and Ribbon Snakes, are well known in North America. The Hog-nosed Snakes of America (genus *Heterodon*) and of Madagascar belong to this sub-family.



TOP OF HEAD (A), UNDER PART OF BODY, AND SUB-CAUDALS (B) OF COMMON SNAKE.

SUB-FAMILY COLUBRINÆ.

The True Colubrides—sub-family Colubrinæ—afford, according to Günther, the most perfect examples of the innocuous Snake, and they are not characterised by the excessive development of some particular organ, but by the fairness of the proportions of all parts. They are Land Snakes, but they swim well when driven into the water, and they climb in search of food. The genus *Coluber* is almost world wide, being found in North America, Europe, Asia, and Africa. The Schlangenbad Snakes belong to this genus, and the species was sacred to Æsculapius.

The Snakes of the genus *Composoma*, like those just mentioned, have the maxillary teeth equal in length, and are Indian, the genus *Spilotes* being their American representative.

The Black Snake* is slender, with smooth lustrous scales. It is black above and blackish-ashy below, with a white throat, and is common in North America. It grows to a considerable size, and is a most active and bold Snake, possessing, moreover, great powers of constriction. Hunting after small birds, it climbs trees easily and robs their nests. In the West it is a persistent enemy of the Rattlesnakes. It hunts them, and boldly seizes them, enveloping their bodies in its constricting folds. It is sometimes included in the genus *Coryphodon*, which has species in America, Africa, and the East Indies. The Pantherine Snake† of the Brazils is one of its species.

The Indian Rat Snake‡ belongs to the group, and is very common on the continent of India and Ceylon. It is scarcer in the Archipelago and in the Himalayas, which it ascends to 5,240 feet above the level of the sea. It is a powerful Snake, attaining to the length of seven feet, and its food consists of mammals, birds, and frogs. It frequently enters dwellings in search of mice, rats, and young fowls, and is of fierce habits, always ready to bite, and they are not to be tamed readily.

* *Bascanium constrictor*.

† *Coryphodon pantherinus*.

‡ *Ptyas mucosus*.

SUB-FAMILY CORONELLINÆ.

The Ground Colubrids, or Coronellinæ, are Snakes of small size, with smooth scales. They live on the ground, and are generally of rich, brilliant coloration, and only a few which frequent grassy plains are of a bright green colour. The genus *Coronella* has species in almost every part of the temperate and tropical regions, and there is a doubtful one in India. The European *Coronella levis* is the type, and is found from Norway to the south. It is possibly an English Snake.

Another genus (*Cyclophis*) is interesting because it is represented by different species in North America, China, Afghanistan, Mesopotamia, Hindostan, Ceylon, and Assam. They have all the



CORONELLA LÆVIS.

teeth of equal size, and none are grooved. They are small Snakes, and as they frequent grassy places, their colours are principally green and olive. They belong to a sub-family, the Dryadinæ, or Bush Colubrids, some of which have the long body more or less compressed, as it were, but not so excessively slender as the true Tree Snakes. The tail is also long, and the head, distinct from the neck, may have an elongate snout. The All-green Tree Snake of South America * and the Antillean Snake, † with large eyes and elongated scales, have been brought to England. Nearly all the species are arboreal.

* *Philodryas viridissimus*.† *Dromicus antillensis*.

FAMILY CALAMARIDÆ.

This is a family of small Snakes with rather rigid, cylindrical, elongated bodies terminating in a short tail, and they are called Dwarf Snakes. The head is but slightly distinct from the neck, and the small nostrils are lateral, and some of the head-shields are united, so that in some species there are two pairs of frontal plates, and in others but one. The body and tail scales may be smooth or keeled, and are in from thirteen to seventeen longitudinal series.

The White-bellied Dwarf Snake* may be taken as the type of the genus *Calamaria*. It has a single pair of frontal plates and thirty rings of scales, those under the tail being double. This little Snake is about eleven inches long. The head is brown, and the body, of the same colour, is ornamented with four longitudinal marks on the side and beneath. There is much white colour beneath. It is an East Indian form, and lives on small mammals and worms, and is, perhaps, the most fragile of all Snakes, and it falls a victim to Bungari and other Snakes.

In the family Oligonitidæ there is a peculiarity about the dentition, one of the genera having no palatine teeth,† and another having the last tooth of the upper jaw longer than the others, and sometimes having a groove on it.‡

FAMILY PYTHONIDÆ.—THE ROCK SNAKES.

These reptiles are occasionally found of great size, and are the largest of the Snakes. They are fortunately not common, and yet they have a very wide and somewhat remarkable geographical distribution. They are found in the hottest parts of Africa, Asia, the Eastern Archipelago, and Australia, according to Günther, and thus link together those distant lands in a former continental space. For the Pythons, although liking water and swimming, could not, and do not, pass from land to land by sea; and, therefore, the ancestors of those in the separated districts were once free to invade over the ancient and now partly sunken intervening lands. Living to a great age, having few enemies, except man, they reach the length of thirty feet, and have the circumference in their largest part of that of the body of a man. But those having the length of from eighteen to twenty feet are rare, and the commonest are found within that length, and their thickness is that of a man's thigh. Climbing as well as swimming, and able to move rapidly over the ground, the Rock Snakes, constituting the genus *Python*, attack animals such as small deer and others of the same size, and birds. They seize their prey after the fashion of other non-venomous Snakes, with their teeth, and then coil their body round it in a few or several folds, crushing and smothering it. They occasionally kill larger animals than they can swallow; but when one is within their coils which can be got down, the head of the victim is taken in first, and then the rest follows slowly; and the passage, often difficult enough in consequence of the size, hairs, horns, or feathers, is assisted by the production of a lubricating saliva. It is a curious sight to see a couple of ducks seized one after the other and bolted by a captive Python, and it is evident that after the meal the creature becomes very disinclined to move. In a state of nature, if a large animal has been swallowed, the Python becomes torpid and may be easily killed. They have the character of being fierce, and of showing great determination when brought to bay. They grow slowly, and one which was brought to London having a length of eleven feet, attained twenty-one in ten years; but the growth is quicker in the early periods of life, this eleven-foot specimen being about four years of age. The males are smaller than the females.

There are two species of *Python* in India. One is common in the Archipelago, inhabiting most of the islands, and feeding on quadrupeds and birds. It often takes up its abode in outhouses, catching its prey at night, and is useful in destroying vermin, although it occasionally causes havoc amongst poultry. Very fond of water, it usually reaches a length of sixteen feet, but some of thirty feet have been seen. It is the Ular sawa of the Malays. § The other one is the Adjigar of the Hindoos. || This great Snake has been said to destroy a Buffalo, which it certainly could not swallow; and there is a well-known engraving representing a man seized by one of these monsters.

There are two Pythons from West Africa, and one of them ¶ is to be seen in the Zoological Gardens of London; and when in full vigour, after having cast its skin, is iridescent with rainbow

* *Calamaria albiventer*.

† Genus *Oligodon*—Java and Ceylon, India.

‡ Genus *Homalocranion*—North America and Venezuela.

§ *Python reticulatus*.

|| *Python molurus*.

¶ *Python Sebe*.

tints on its grey body. It closely resembles the Natal Python, which Dr. Andrew Smith describes as occasionally reaching twenty-five feet in length. It may be the Indian species last alluded to. Formerly an inhabitant of the Cape Colony, it is now not to be found for hundreds of miles from its boundaries, and few specimens have been found nearer than Port Natal.

Dr. Scater, F.R.S., has shown that the African Python* and the Indian Adjigar† incubate their eggs. These are of the size of those of a goose, and fifteen were laid on a 6th of May.



THE INDIAN ADJIGAR.

The Snake (the African one) collected them in a conical heap, coiled herself round and on it, entirely covering the eggs, and her head rested on the top of the cone. The Snake remained in that position until eight of the eggs were hatched on the 3rd of July. An increase in the temperature of the Snake has been observed during the hatching. The Snakes of this family have the relics of hind limbs in the shape of bony spurs, and the tail is prehensile; it enables the Python to cling on to the stump of a tree or a rock whilst arresting the escape of the prey. The head has

* *Python Sebae*.

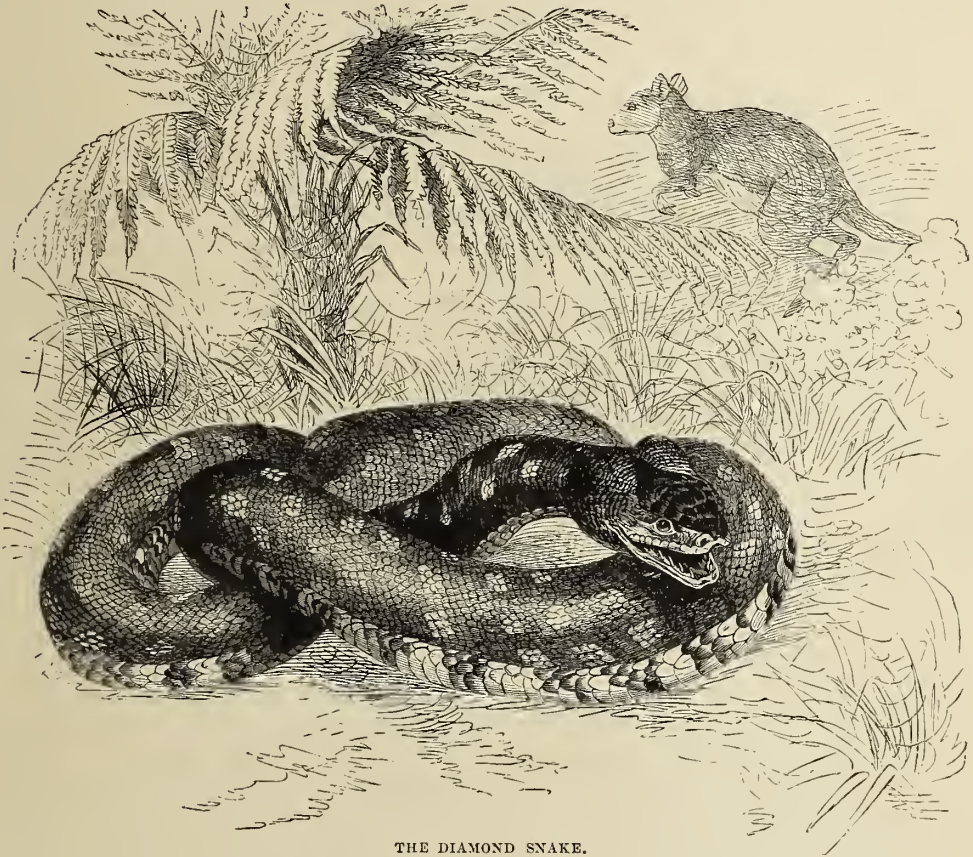
† *Python molurus*.



rather a long snout, depressed and cut short, or rounded in front. The eye is of moderate size, and the pupil is vertical. The scales are smooth, very numerous in series, and the sub-caudals are two-rowed. None of the teeth are grooved, and they are found in the intermaxillary, maxillary, palatine, pterygoid, and mandible bones, and they are unequal in size.

Associated with the Pythons, which are the types of a sub-family, are some beautiful Australian Snakes, which are usually said to belong to two species, the Diamond and Carpet Snakes, but which in all probability are races, or local varieties of one.*

The next sub-family of the Pythonidæ to be considered is that of the Boas, and they have the



THE DIAMOND SNAKE.

general configuration of the Great Pythons, but some have the head scaly and without plates, whilst others have irregular plates. In all the tail is prehensile, but the intermaxillaries have no teeth. All are South American, except some belonging to a genus whose place in classification is uncertain, and whose species live in Java.

The Boa Constrictor has a long scaly head, which is broad behind, and the tail has a single row of sub-caudal scales. They are arboreal, and watch for their prey, swooping down on it head first, seizing and coiling their long and stout body around it. They reach twelve feet in length as a rule, and it is said that some are twice and more as long, but there are grave doubts about the truth of the statement. The ornamentation is rather peculiar, and there is a long series of markings extending the whole length, composed alternately of great blackish stains or spots irregularly hexagonal, and of pale oval stains or spots notched or jagged at either end, the whole forming a very elegant pattern. It has the habits of the family, and is restricted to the tropical parts of South America. Probably

* *Morelia argus* and *M. variegata*.

this was the Snake which was worshipped by the natives, and it has a strange literature attached to it, of stories of the most wonderful kind, and it has been confounded with the Anaconda, which forms the next genus of the sub-family.

Bates, once on an insect-hunting expedition, met a Boa Constrictor face to face. The huge Serpent was coming down a slope, and making the dry twigs crack and fly with its weight, as it moved over them. He knew there was no danger and stood his ground, and the reptile suddenly turned and glided at an accelerated pace down the path. The rapidly-moving and shining body looked like a stream of brown liquid flowing over the thick bed of fallen leaves rather than a Serpent with a skin of varied colours. One morning, after a night of deluging rain at Pará, the lamplighter, on his rounds to extinguish the lamps, knocked Bates up to show him a Boa Constrictor he had just killed in the street not far off. He had cut it nearly in two with his knife as it was making its way down the sandy street.

The ability of Snakes to swallow prey, the size of which is greater than that of their heads and necks, might be called in question were it not a very familiar spectacle. Whether the victim has been struck and poisoned, or bitten and enfolded in some twirls of the body, or simply caught in the mouth, sooner or later it is forced within the jaws, and the skin of the head is greatly distended. The crooked shape of the teeth prevents the return of the prey, which is forced farther and farther back, by alternate forward movements of the movable and separable lower jaws, by gapings and general forward movements of the jaws. As the prey gets beyond the middle of the mouth the lower jaws are separated behind from the skull, as much as possible, by the mobility of the quadrate and squamosal bones, and then the extensile gullet receives its morsel. Once past the jaws, the muscular efforts are restricted to the gullet and body.

A clean skull of a Python, with its bones in their proper place, shows how solid is the brain-case, and how movable are the jaws and their attached bones. On looking at this Snake's skull the pre-maxillary bones are seen in front, and there are teeth in them. This is (with the exception of the genus *Tortrix*) not the usual arrangement, for teeth are wanting there in other Serpents.

Then the maxillary bones (on each side) are large, long, arched, and many-toothed, and very different in shape to those of the venomous Snakes. Within the mouth, and on the palate, is the palatine bone (of each side), also furnished with teeth, whose points look backwards, and the bone is long and is united behind with the pterygoid. Just where they unite a bone passes out to join the maxilla, and this is the transverse bone. The hinder end of the pterygoid bone is in contact with the quadrate and squamosal bones. This last bone (squamosal) is long, and only adheres to the skull by one end, the opposite or outer end being in contact with the quadrate bone. Hence the quadrate bones can be stuck out from the skull by their own and also the length of the squamosal. On looking at the lower jaw the parts at the chin are noticed to be capable of wide separation there; and behind, the mandibles jointed to the quadrate can be forced as widely apart as that bone and the squamosal will let them. Hence the space through which the prey can pass is wide. In the *Tortrix* (p. 335), which has the exceptional pre-maxillary teeth, the quadrate bone is articulated directly with the skull, the squamosal being rudimentary. So it cannot bolt great morsels.

The great water-loving Snake of Brazil, about which so many wonderful stories have been told, is the Anaconda,* and it has often been confounded with the Boa Constrictor. Its head is furnished with irregular plates, and that of the Boa is simply scaly. It grows to a great size, however, and a large specimen is usually to be seen in the Zoological Gardens of London. Lying in great coils, with the scales iridescent after it has cast its skin, this Snake may be seen with its prey—a couple of ducks—in its lively moments. Often, however, it is wonderfully inert, and the birds even rest on it and *quack, quack*, with full tones. Sooner or later, however, a long head, rather wide behind and with a notable set of teeth, moves upwards out of the coil, and there is a rush forward, and a duck is caught. Soon it disappears down the stretched-out mouth and throat, and the other one follows after an interval. They last long, indeed many months, without food, and in their native home live in and about rivers and swamps, preying on birds and small mammals.

* *Eunectes murinus*.

The sub-family of the Boas also contains the Tree Boa of South America,* Mexico, and the West Indies, and two other genera of West Indian Snakes. These are represented by the Pale-headed Tree Boa of Cuba† and the Yellow Snake of Jamaica.‡

FAMILY ERYCIDÆ.—THE SAND SNAKES.

These resemble the Pythons and Boas in their internal and in most external characters, but their tail is short and not flexible or prehensile, and the head is hardly distinct from the neck. They are not arboreal, but frequent sandy or dry places and plains, burrowing easily beneath the surface, and entering crannies and holes in search of their prey, which consists of mice, lizards, and other burrowing snakes. They move with great rapidity. They are nocturnal, more or less, and are found in Northern Africa, South Europe, and the islands of the Mediterranean, Asia Minor, Hindostan, Sikkin, and part of Arabia.

THE FAMILY OF SHORT-TAILED SNAKES, OR ROLLERS.—THE TORTRICIDÆ.

The Snakes of this family are cylindrical in shape, and rather rigid in their bodies. They have a small, conical, stumpy tail, a short and indistinct head, and little teeth, some being on the palatine bones, and the scales are smooth. They have a rudimentary pelvis with horny spines projecting close to the vent, and there are relics of the hind limbs. One species has teeth on the pre-maxillary bones, like a Python, as well as on the usual bones. This is *Tortrix scytale*, which inhabits Guiana. It is a small, innocuous Snake, which lives above ground in boggy places, preying on worms, insects, and small reptiles. Probably it cannot swallow anything large, as the quadrate bone is articulated directly with the skull, the squamosal being rudimentary.

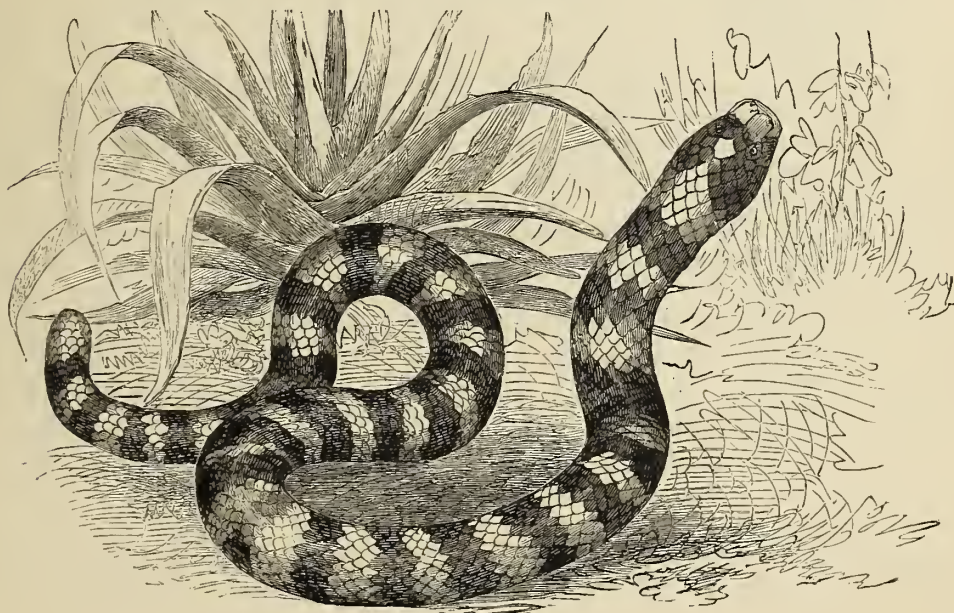
Another genus of the family is represented in Java by the Red *Cylindrophis*; but this Snake has no teeth on the pre-maxillaries. It is made a pet of, and sometimes worn as an ornament. Finally, in the genus *Xenopeltis* of India the squamosal bone does not form part of the wall of the skull.

The last family of the Colubriform Snakes is closely allied to the Rollers. Its members have a cylindrical body, a short and pointed head, a non-extensile mouth, and a short truncated tail, with a naked terminal plate, or it is replaced by keeled scales. There are teeth on both jaws, and there is

* *Corallus hortulanus*.

† *Epicrates angulifer*.

‡ *Chilobothrus inornatus*.

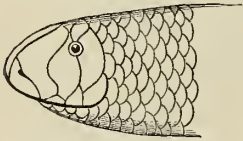


TORTRIX SCYTALE.

a fold in the throat which permits of the extension of the skin. The eyes are very small. These Uropeltidæ, having such remarkable Saurian affinities, live in the East Indies and in Ceylon, and it is necessary to dig to a depth of four feet to obtain them.

SUB-ORDER TYPHLOPIDÆ.—THE BLIND SNAKES.

These are small Snakes, and are by no means readily distinguished by an ordinary observer from the Sheltopusiks, Blind-worms, Amphisbænæ, and other Lacertilia with Snake-like bodies, and more or less imperfect limbs. They lead a life like that of the burrowing Anguis (p. 297), their bodies are vermiform, cylindrical, and rigid, and there are the relics of hind limbs in the form of small rod-shaped bones. They are not blind, for the eyes are present, although small, but they are covered by the ocular and pre-ocular shields, which are more or less transparent. The teeth are found in the upper and lower jaw according to the genera. These Snakes are allied to the Lizards in that they



SIDE VIEW OF HEAD OF
BLIND SNAKE. (After Gün-
ther.)

have the long axes of the palatine bones transverse, and there is no transverse bone as in the Snakes proper. Moreover, the pterygoids are not connected with the quadrate bone. They have not the power of enlarging their narrow mouth, and they feed on small worms and insects. They are divided into two families: in one, the Catodontes, there are teeth only on the lower jaw, which is shorter than the upper; * in the other, the Epanodontes, the teeth are on the upper jaw, and the extremity of the muzzle is truncate and covered with large scales, the nostrils being situated laterally on the anterior margin. *Typhlops lumbricalis*, of the Antilles, is the type. Some other small Blind Snakes, with the rudiments of hind extremities hidden beneath the skin, and a small eye covered by the ocular and pre-ocular shields, are inhabitants of almost every part of the tropics, and about eight species occur in British India, and the most remarkable is *Typhlops tenuis*.

The Australian Blind Snake is *Typhlops Rüppelli*, and it lives in ants'-nests.

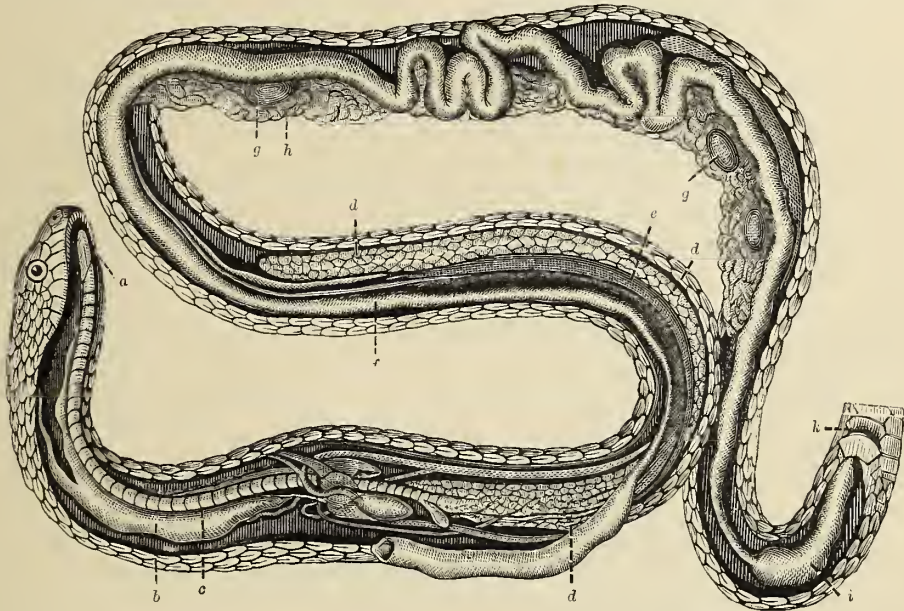
In concluding this natural history of the Serpents it is necessary to make a few remarks on some of their more important peculiarities of structure. The tongue, that long, rapidly-moving organ, which is evidently often used as a feeler, as well as a menacing agent, is slender, cylindrical, and forked. It is lodged in a membranous sheath, the opening of which is situated near the anterior part of the mouth, and the reptile can protrude it from the mouth to nearly its whole length. The œsophagus and stomach form a continuous tube of variable length, and it is difficult to determine where one ends and the other begins. But the stomach is strengthened by muscular layers, and the folds in it are more numerous. It is short in relation to the length of the reptile, and any large prey is retained partly in the œsophagus. There are two parts, one of which, in front, is the "sack," and the other the pyloric end, and this is more or less bent on the other. It has no folds, and has to deal with the more or less digested food. The intestine is much looped in the True Serpents, and this seems to refer to the movement of the reptile on its belly, and the possibility of this acting perniciously on a simple elongated gut. That of the Water Snakes is simpler. They all have a lobed liver, a spleen, and a pancreas.

They have a complicated lymphatic system, and there are lymphatic hearts situated just above the origin of the tail, and they are large in the Python. A diminished and atrophied condition of one of the lungs has already been noticed in some Lizards, and it is found in the Serpents, and has to do with the room which great prey requires when swallowed. It is not necessary to refer to the circulation, except to notice that the ventricular septum is incomplete. The great nervous centre has the two hemispheres broader than long, the olfactory bulb is frequently of large size, and the corpus striatum is smaller than in the Lizards. The cerebellum is very small and flat, and the so-called bigeminal tubercles are well developed.

In the ear there is no proper tympanic cavity, and the handle of the auditory ossicle is embedded amongst the flesh, so that its extremity only touches the skin, close behind the articulation of the jaw.

* *Stenostoma nigricans*, an African species, is the example.

The eye of Serpents is protected by an eyelid of a very remarkable character; for that it is an eyelid, and not, as is very generally supposed, the cornea, its anatomical relations abundantly prove. It consists of a transparent membranous expansion, which is immovably fixed in a kind of frame formed for its reception by a circle of scales, usually seven or eight in number, disposed around the margin of the orbit. This eyelid is formed of three superposed layers. First, an epidermic layer which is elastic and pretty thick where it covers the middle of the eye, but towards the circumference of the eyelid it becomes thinner, and is manifestly continuous with the epidermis that invests the scales in the vicinity of the orbit. This corneous lamella, by its solidity, is well adapted to defend the eye, and it is this which becomes detached and cast off with the slough of the Snake when it moults its skin. Secondly, beneath this epidermic layer is a second membrane, which is the middle tunic of the eyelid. This is very delicate and soft, and perfectly transparent in the centre, but towards



THE VISCERA OF A SERPENT.

(a) Mouth; (b) Gullet; (c) Trachea; (d) Lung; (e) Liver; (f) Stomach and Intestine; (g) Egg; (h) Ovary; (i) Cloaca; (k) Vent.

its circumference it encloses some opaque whitish fibres, supposed by Cloquet to be muscular. This layer, at the margin of the orbit, is manifestly continuous with the skin; internally it is lined by the third layer, which is mucous, being, in fact, the membrana conjunctiva, which is reflected on to it from the surface of the eyeball. All around the circumference of the eyelid there is a whitish, granular, transparent substance, the nature of which is apparently glandular.

The conjunctiva lines not only the internal surface of the eyelid, but also a large portion of the cavity of the orbit, from which it is reflected on to the front of the eyeball, thus forming a complete sac without any opening externally.

The skin comes off the eye during the periodical moult of the cuticle of the body, and for some little time before it looks dull and discoloured; and when it has been cast, the new covering is perfect in its transparency.

During the moult the Snakes hide up or are quiescent, and the whole skin comes off in one or more pieces.

In conclusion, it may be remarked that the Ophidia have not a great geological age, and the first lived in the early Tertiary age. The remains of a Snake belonging to the Python group, twelve feet in length, were discovered at Sheppey; others of a Boa, twenty feet in length, came to light at Bracklesham. The vertebræ are perfect, and they belong to the fossil genus *Palæophis*. Others were found at Hordwell in higher strata. In later Tertiary deposits the presence of a

venomous Snake has been noted, and a vertebra of a huge Coluber was found in the Miocene of the South of France. In the fossiliferous deposit at Eningen three species of Coluber have been found.

The fossil remains of Serpents in North America occur in lower Tertiary deposits. The genus *Dinophis* was one of the Sea Snakes, and the species attained the length of thirty feet. Snake remains are abundant in the fresh-water Eocene deposits of the Western States, but they are of moderate size. They are related to the Boa Constrictors and others. A few fragments have been found in later deposits. There are a few remains of fossil Snakes in the Tertiaries of India.

CLASSIFICATION OF THE ORDER OPHIDIA.

SUB-ORDER.—THANATOPHIDIA (Venomous Snakes).			
FAMILY ELAPIDÆ.—Venomous Terrestrial Colubrines	.	Example—Genus	<i>Naja</i>
" HYDROPHIDÆ.—Venomous Water Colubrines	.	"	<i>Pelamis</i> .
" SOLENOGLYPHIA.—Viperine Snakes	}	"	<i>Pelias</i> .
SUB-FAMILY VIPERIDÆ.—Vipers		"	
SUB-FAMILY CROTALIDÆ.—Pit Vipers	.	"	<i>Crotalus</i> .
SUB-ORDER COLUBRIFORMES.—Innocuous Colubriform Snakes.			
FAMILY ACROCHORDIDÆ.—Wart Snakes	.	Genus	<i>Acrochordus</i> .
" DRYIOPHIDÆ.—Whip Snakes	.	"	<i>Passerita</i> .
" DIPSIDÆ.—Nocturnal Tree Snakes	.	"	<i>Dipsas</i> .
" LYCODONTIDÆ.—Ground Snakes	.	"	<i>Lycodon</i> .
" AMBLYCEPHALIDÆ.—Blunt-heads	.	"	<i>Amblycephalus</i> .
" DENDROPHIDÆ.—Tree Snakes	.	"	<i>Bucephalus</i> .
" PSAMMOPHIS.—Desert Snakes	.	"	<i>Psammophis</i> .
" RACHIODON.—Throat-toothed Snakes	.	"	<i>Dasypeltis</i> .
" HOMALOPSIDÆ.—Fresh-water Snakes	.	"	<i>Hipistes</i> .
" COLUBRIDÆ.—The True Snakes	.	"	<i>Coronella</i> .
SUB-FAMILY NATRICINÆ.—Ringed Snakes	.	"	<i>Tropidonotus</i> .
" DRYADINÆ.—Bush Snakes	.	"	<i>Herpetodryas</i> .
" CALAMARIDÆ.—Dwarf Snakes	.	"	<i>Calamaria</i> .
FAMILY PYTHONIDÆ.—Rock Snakes	.	"	<i>Python</i> .
" ERYCIDÆ.—Sand Snakes	.	"	<i>Eryx</i> .
" TORTRICIDÆ.—Rollers	.	"	<i>Tortrix</i> .
" UROPELTIDÆ.—Rough Tails	.	"	<i>Uropeltis</i> .
SUB-ORDER TYPHLOPIDÆ.—Blind Snakes.			
FAMILY CATODONTES	.	"	<i>Stenostoma</i> .
" EPANODONTES	.	"	<i>Typhlops</i> .

THE EXTINCT REPTILES.

In describing the Chelonia, Crocodilia, and Ophidia, attention was paid to the kinds which lived in ages gone by. It is now necessary to draw attention, very briefly, to the Fossil Reptiles, which cannot be exactly classified in the same great groups as those now mentioned, and also to those which may, with greater or less propriety, be connected with the Sauria or Lacertilia. They have been found in the Permian deposits, and in those of the consecutive ages to the Pliocene, but the Trias, Lias, and Oolitic strata in the Old World, and the Cretaceous strata of the Old and New Worlds, contain the greatest number, and the structural affinities of the extinct kinds with the recent, and with Fish and Birds, are very remarkable.

THE DINOSAURIA.

These reptiles attained the greatest size of any animals living on land, but some of them were mere pigmies. Thus, the *Iguanodon* of the English Wealden had a thigh-bone four feet in length, a *Cetiosaurus* found in the Oolites must have been ten feet in height, and the American *Titanosaurus* was no less than sixty feet in length and thirty feet in height. On the other hand, *Nanosaurus*, an associate of the other and greater one, was no larger than a Cat. They began to live in the age of the Trias, and died out in the Cretaceous age, and had a vast geographical range. Most of the kinds walked mainly on their hind feet, like modern Ostriches, and many left the impression of their bird-like feet on the rocks. They had small fore-limbs, and a large tail. They were herbivorous as a rule, but there was a carnivorous group also. A genus was found preserved in the Solenhofen slate, called *Compsognathus*, and it has some of the parts of the skeleton transitional between the Wingless Birds, the Crocodilia, and the Sauria. Some had Crocodile-like heads, with beaks and teeth like a Lizard (*Iguana*), and others had recurved, serrated, huge teeth and shortish heads. The Solenhofen specimen had a very bird-like head with teeth, a long neck, short fore and long hind limbs.

The vertebræ differ much in this group in size and number. As a rule the bodies were slightly concave before and behind, or nearly flat; but in some instances the cervical vertebræ were hollow behind only, the dorsal were flat, and those of the tail amphicæalous. Chevron bones were attached between the tail vertebræ; and the sacrum appears not to have been formed by less than four vertebræ. These reptiles had long narrow scapulæ, no clavicles, and the coracoid was rounded. The femur is bird-like at its farther end, and the inner and outer digits are either shorter than the rest or quite rudimentary; and the third digit is the longest, as in the birds in general (Huxley). The bones of the pelvis were much like those of birds.

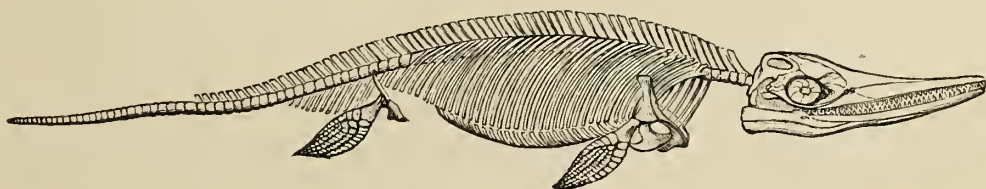
THE ORNITHOSAURIA.

Flying reptiles, but not fashioned on the principle of the modern little Dragon, existed in the Secondary age of the world, and must have been common in Europe and America. The largest had a spread of wing of from ten to twenty-five feet, and were found fossil in the remains of the inland Cretaceous sea of North America. Smaller than these, but furnished with teeth (which the others had not), were those of Europe, some of which were as large as the Albatross, and others no larger than a Blackbird. The American kinds are called *Pteranodontia*, and the European *Pterodactyles*. In some of the European kinds there were no teeth in the front of the jaw, and the others were implanted in sockets, but there was a beak (*Ramphorhynchus*). This kind had a very long tail. In others (*Dimorphodon*), the front teeth were large and pointed, and the others small. The true *Pterodactyles* had short tails, teeth throughout the jaws, and the little finger with four long joints. A membrane was attached to them, to the fore arm, to the flanks of the body down to the tail, and it stretched thence to the ankle, and passed over to the end of the little finger. No other fingers were included in the great skin wing. No feathers existed, but the limb-bones were hollow and light. The breast-bone had a keel like the flying birds, and there was a scapula, and also a coracoid very bird-like. The head had great orbits, and was long and light, and a ring of sclerotic plates was on the eye. The brain-case was like that of the bird. They lived in the age of the Lias to that of the Cretaceous inclusive.

THE ICHTHYOPTERYGIA.

An order of extinct reptiles, the *Ichthyopterygia*,* contains gigantic massive forms which combined a fish and lizard-like construction, and were highly predaceous. They had a long head, a very indistinct neck or fish-like body, and a long tail. The body was covered with skin, and not with scales or plates, and there was probably an upright fin on the tail, which added to the compressed look of the body. Huge eyes, whose sclerotic had many bony plates, were placed at the side of the head; and the gape was wide, the teeth long and stout, and not planted in sockets, but in a common groove. They breathed by means of lungs, and the ribs were numerous, false ones being developed on the under part of the abdomen. The vertebræ were very numerous, and the bodies biconcave, and the neural arch was united to them by a distinct suture. There were neither sternum nor sternal ribs, and the sacrum consisted of two vertebræ; but scapulæ, coracoids, clavicles, and interclavicles existed. The fore and hind limbs were in the form of paddles, the digits consisting of numerous groups of five, with extra or marginal bones. The similarity of these in plan to those of the *Cetacea* or Whales is very remarkable. These reptiles attained a vast size, and flourished especially in the Lias of Europe, and lived to the close of the secondary age. They could swim by the side lash of the tail and the propelling action of the paddles; and doubtless, from the size of the orbit, the large

* Fish-fin.



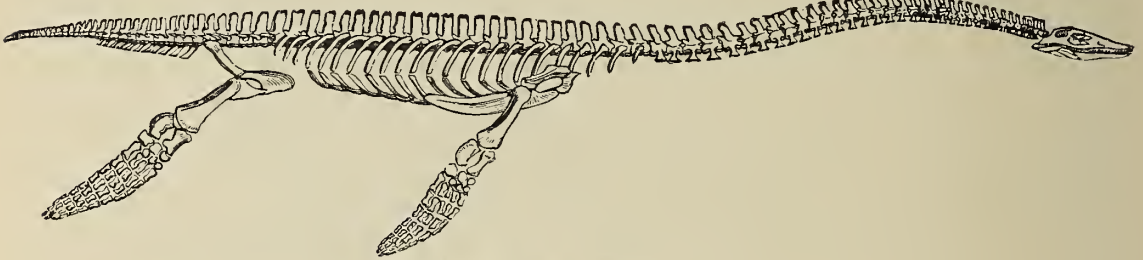
SKELETON OF ICHTHYOSAURUS.

eye could collect the feeblest rays of light when chasing prey under water. They appear to have beached themselves occasionally on shore, but they could not walk. Professor H. G. Seeley, F.R.S., has shown, by good evidence, that they were viviparous. They do not appear to have bred in the American seas of the age. There were many species of the genus *Ichthyosaurus*, and they have the nostrils high up in the snout near the orbits, and their opening in the palate was behind the long palate bones.

Professor O. C. Marsh has founded a new order of extinct reptiles, the *Sauranodontia*, from specimens obtained in the Jurassic strata of the Rocky Mountains. They were apparently *Ichthyosaurs* which had no teeth, the jaws being even destitute of a groove for holding them. All the other peculiarities of the *Ichthyosaurs* (which have, as yet, not been found in America) are present, and their length was from eight to nine feet.

ORDER PLESIOSAURIA.

A most extraordinary group of marine reptiles lived during the Secondary ages of the world, and the first skeleton discovered, and which belonged to a kind which flourished in the days of the Lias, excited much attention. It had a very small head like a Lizard, a neck extremely long and snake-



SKELETON OF PLESIOSAURUS.

like, a plump body, and a distinct and shortish tapering tail. The limbs were short, the hinder pair being the longer, and they were furnished with paddles, differing somewhat from those of *Ichthyosaurus*. Dr. Buckland compared it to a Turtle with a Snake drawn nearly through it. The Plesiosaur, as it was called, swam probably on the surface, and fed like a Swan, but most likely on fish and small reptiles. It had no scales, but probably a smooth skin. There were no fins; and the teeth, as seen in the preserved fossil skulls, are sharp-pointed, curved backwards, and each is placed in a distinct socket, but it does not unite to the jaw by a bony union. The snout tapers, and is flattish, and the orbits are large, but the eye had no sclerotic plates. The outer nostrils open just before the eyes, and the premaxillary bones, usually small in reptiles, are large, and form a large portion of the snout. The inner nostrils appear to be in front of the palate bones, and are separated by the vomers. The head, not much more than one-twelfth part of the length of the body, moved readily by a large condyle on the very movable neck, which has in some kinds more than forty vertebrae. These are faintly biconcave, and the neural arch is not united by bony union. Some ribs, not unlike those of the Crocodile, exist near the root of the neck, and in the body there are transverse processes with curved ribs jointed to them. There are from twenty to twenty-five back vertebrae, and two sacral, whose ribs are broad for the attachment of the ilium. Thirty or forty tail vertebrae succeed, and they have chevron bones. There are thus ribs to the vertebrae, and there are none to the sternum, and this is compensated by a system of ossifications in the walls of the abdomen, arranged in cross rows, each consisting of a middle bone slightly bent on itself, and of six others, three on each side, their pointed ends overlapping. The arrangement of the bones of the shoulder and chest is very remarkable. The sternum is small and band-like, its place being occupied, as it were, by two great coracoids. The blade-bones, small and long, differ from those of any other reptile, and there is an epicoracoid. No clavicles exist, but in some kinds that lived during the Trias they are found. The fore limb ends in five digits, composed of metacarpals and phalanges constricted in the middle, and which are numerous in the middle digits. The pelvis is large, to fit the corresponding large limb, and all the bones are present. The femur much resembles the humerus, and the toes those of the fore limb.

All the extremities were encased in flesh and skin, like the flippers of Whales. These fast-swimming surface skimmers began in the Trias, and the early kinds, such as *Notosaurus*, differed somewhat from those which followed, or the genera *Plesiosaurus* and *Pliosaurus*. The first has been described, and the kinds of the other differ, by having the vertebræ wide in proportion to their length, and deeply excavated before and behind. The head is bigger, the neck shorter, and the paddles are larger.

The American forms belong to the last-named genus; and the first was represented in the Southern hemisphere in Secondary strata in New Zealand.

THE EXTINCT SAURIA, OR LACERTILIA.

It was noticed, in describing the remarkable Lizard from New Zealand—the *Tuatéra*, or *Sphenodon*—that it was allied to *Rhynchosaurus* and *Hyperodapedon*, Triassic forms.

Other extinct Lizards of small size, whose anatomical characters resemble in many important points those of the Lacertilia with amphicœlous vertebræ, like the Gecko, have been found in the strata of the early Secondary ages. *Telerpeton*, from Elgin in the Trias, is one of these, and the group are called the *Homœosauria*. The Eocene Lake basins of Western North America contain numerous fossil remains of Lizards. Some have a bony coat of mail, others are scaly, and a few somewhat resemble the Iguana. Others were found in the Miocene and Pliocene deposits.

The *Protosauria* are the oldest of the Lizards, and the remains of one, six or seven feet in length, with a long neck and moderately-sized skull, a long and slender tail, and its limbs as well developed as they are in existing Monitors, were found in the Permian deposits of Thuringia. It had very few cervical vertebræ, all of which are slightly amphicœlous. The teeth, sharp pointed, were implanted in sockets, and its extremities had five digits, which were arranged like those of the Geckos. Another, called *Bathynathus* (deep jaw), is from the Trias of Prince Edward's Island.

Owen described a fossil Lizard from the Cretaceous with a long neck and body like an eel, and with limbs. It is called *Dolichosaurus longicollis*.

He has also described, from South Africa and Hindostan, a form with two huge upper teeth like tusky canines not unlike those of the *Morse* (Vol. II. p. 212). The lower jaw was armed with a cutting horn, and the reptile swam well. This *Dicynodon* is of the age of the Permo-Trias, and it belongs to a family—the *Dicynodontia*. Closely allied are the *Cryptodontia*, whose teeth are either inconspicuous or absent, such as the genus *Oudenodon* of South Africa. The *Cynodontia*, a South African family, is of late Palæozoic and early Secondary age, and there is a pair of teeth in each jaw like the canines of carnivorous animals, and they divide incisors from molars. *Galeosaurus* is the most remarkable.

Owen has also described a huge Lizard from the latest Australian deposits. Its skull has horns, and belonged to a form which was somewhat like *Moloch horridus*, and was as large as an ox.

The *Mosasauria* were Lizards; they were great, long-bodied, and some, very Snake-like marine creatures. They are found in the Cretaceous deposits of Europe, and Maestricht yielded the first. It had eighty-seven procœlous vertebræ, and the skull was not unlike that of an Old World Monitor; but the sharp recurved teeth were anchylosed to the pre-maxillary, maxillary, pterygoid, and dentary bones, and the pterygoid bones are unlike those of any recent kinds. There were North American kinds of this group of vast size, which had four paddles, a vast number of vertebræ and ribs, and teeth big enough to vanquish all enemies. They abounded in the Cretaceous seas of the Far West, and some reached the length of sixty feet.

P. MARTIN DUNCAN.

NOTE.—It was stated in p. 236 that the *Archæopteryx* was a member of the *Saururæ*, a group of birds, but a specimen, now in the Berlin Museum, has been examined by Carl Voght, of Geneva, and it appears to be a Lacertilian which had feathers. There are two small conical teeth in the upper jaw. There are eight cervical vertebræ, which have five ribs directed backwards; the dorsal vertebræ are ten in number, and they have no spinous processes, and their ribs have no uncinate processes. Five sternal ribs exist, and the sternum is very minute. The long tail resembles that of the example already noticed. The fore limb is not a wing, and there are three digits which resemble those of a clawed Lizard, and the feathers are attached to the side of the arm and hand, body and legs, and tail. The hind limb resembles that of a bird, but the rest of the body is Reptilian more than Avian; and if the feathers had not been preserved no one would have thought the *Archæopteryx* a bird or capable of flight. Probably this transitional form, more reptilian than bird-like, moved through the air, not like a bird, but like *Galeopithecus* (Vol. I., p. 346), or the Flying Phalanger (Vol. III., p. 208).

CLASS AMPHIBIA.

CHAPTER I.

FROGS AND TOADS.

Characteristics of Amphibians—Remarkable Skin—The Skeleton—Heart of Frog—Circulation of the Blood—Method of Respiration—Gills, or Branchiæ—The Nervous System—Brain of Frog—The Eyes and Ears—Alimentary Canal—**THE ANOURA, OR THE FROGS AND TOADS**—Distinctive Features—Hibernation—Lungs—Throat-sacs—Teeth—Food—Skeleton—Muscles of Thigh and Leg—Batrachian Locomotion—Their Swimming Powers—The Tongue—The Croakings—Metamorphosis of the Frog—Structure of the Tadpole—Circulation of Blood in the Gills—Last Stages in the Tadpole Condition—**THE BATRACHIANS WITHOUT TONGUES**—The Surinam Toad—Birth of the Young Pipas—**THE BATRACHIANS WITH TONGUES**—**THE OXYDACTYLA**—**THE RANIDÆ**, TRUE FROGS—The Common Frog—Habits—Its Relations with Humanity—Development of the Embryo—The Frog's Skull—The Edible Frog—The American Bull Frog—African and other Frogs—The Horned Ceratophrys—**THE PELOBATIDÆ**—The Obstetric Frog—The Bombinator Igneus—The Brown Mud Frog—The Globose Cacopus Frog—**THE BUFONIDÆ**—The Common Toad—Habits—The Metamorphosis—The Toad has not Escaped Calumny—The so-called Venom—The Natter-Jack, or Rush Toad—The Variable, or Green Toad—The Indian and African Toads—Mr. Darwin on a South American Toad—The North American Toads—The Breviceps—**THE DISCODACTYLES**—**THE TREE FROGS**—The Hyloranæ—The Hyladæ—Their Digits—The Common Hyla—The Goose-footed Hyla—The Elegant Hyla—The Common Golden Tree Frog—The Pouched Frog—The Common Indian Tree Frog—The Spurred Tree Frog—Tree Frogs of Ceylon—The *Acris gryllus*—The Genus *Rhacophorus*—The *Hylodus ocellaris*—The Martinique Frog—The *Phyllomedusidæ*—The Great Green Tree Frog—The *Dendrobatidæ*—The Genus *Plectropus*.

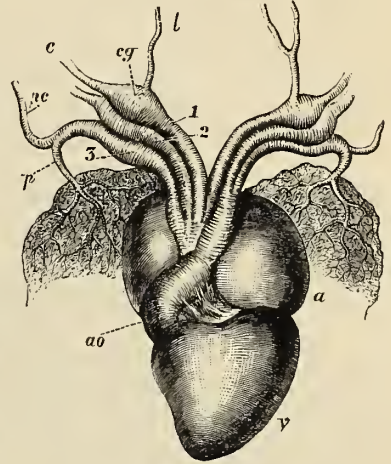
THE vertebrated animals called Amphibia were, as has been already noticed in the Introduction to the Reptilia, formerly included with the Reptiles in a great division of the animal kingdom; now they are placed in a class by themselves, and they have many structural resemblances to the Fish. They are cold-blooded, and their skin is generally naked. They have limbs (with few exceptions), and breathe by means of lungs, or they have more or less persistent gills. Their circulation is incomplete in comparison with that of the Vertebrata already noticed, and the skull joins with the first vertebra by means of two occipital condyles. Finally, the Amphibia, with few exceptions, have an immature or a larval and an adult condition, the first being passed in water, and certain membranes are deficient in the embryo, or unborn. The general shape of the Amphibia indicates that they are fashioned to exist, at some time of their lives, in water and on land, and the body is long and cylindrical, or short and compressed, and frequently there is a long, flat tail, and a back crest of skin. Sometimes there are no limbs—for instance, in the worm or snake-like *Cæciliæ*; in other instances, as in the Siren, there are only short fore limbs, or else the rudiments of fore and hind limbs furnished with weak and limp digits. Even in those kinds which have the limbs and digits well developed, they act principally in pushing the heavy, low body along on the feet. The Batrachians—Frogs and Toads—which have short trunks, tailless in adult age, are the only Amphibia which have two pairs of long and useful active members, which enable their possessors to run, jump, swim, and climb. The skin is of vast importance to the Amphibia as a secreting and a respiratory surface, and it is usually smooth and clammy, or viscid; but the *Cæciliæ* alone, amongst existing Amphibians, have small scales or scutes imbedded in it, and they present the rayed appearance of fish-scales. The skin includes, as a rule, many glands which are either simple and flask-shaped; and they assist, by their secretion, in the process of moulting, or they may be composed of a number of sac-like bodies, and in this case the secretion is often acrid and foetid, and is fatal to small creatures; and, when not so, it is equally viscid, and lubricates the surface and makes it slimy. These complicated glands are collected at certain parts of the body, especially near the back of the jaw in the parotid region, in Toads and Salamanders, and also on the sides of the body and on the hind limbs. The colour of the skin and its shades are produced by colouring granules which are situated in the epidermal cells, and also by the presence of very large branched pigment cells in the skin, which, as in the Frogs, for instance, produce changes in colour by alterations in their shape and position. With regard to the bones of the skull and skeleton, it is remarkable and significant, that in these low Vertebrates they can be compared with and named from those of the higher animals. The bodies of the vertebræ are of bone, and there are intervertebral cartilages; there are also relics of the notochord, an embryonic condition of the vertebral column. The shape of the body of the vertebræ differs in the various groups. The sacrum rarely consists of more than one vertebra, but there are exceptions. With regard to the skull, the base and part of the sides are differently arranged to the corresponding regions in the Reptiles and higher Vertebrates, for the Amphibia have not complete basi-

occipital, basi-sphenoid, supra-occipital, ali-sphenoid bones, or pre-sphenoid cartilage bone, and a great membrane bone, the pre-sphenoid, covers the base of the skull instead, from the occipital to the ethmoid region, as in some Fishes. There are two pre-maxillæ, and the maxillæ are usually present. There are pterygoid bones, and, except in some Frogs, there are palate bones. With regard to the hinging of the lower jaw to the skull, there is a membrane bone called temporo-mastoid, which extends from the side walls of the skull to the articular head of the lower jaw, which has a dentary, splenial, and usually an angular bone entering into its composition. There are no sternal ribs. The heart has but one ventricle, two auricles, and a long swelling to the main artery, which has contractile muscular fibres, and sometimes valves and longitudinal partitions in it called the arterial bulb (*bulbus arteriosus*). But besides these there is a space bounded by contractile walls, into which the venous blood from the body pours, before it enters the right auricle. The left auricle is usually smaller than the right, and a single pulmonary vein from the lungs enters into it. The interior of the ventricle is more like a sponge (Huxley) than a chamber with well-defined walls. The *bulbus arteriosus* springs from it, and ends on each side in either three or four trunks, which ascend upon the branchial arches. The variation in the number of these main trunks, which resemble so many arches in the different groups of Amphibia, is considerable. In the adult and perfect Amphibia the circulation of the blood closely resembles that observed in the lowest or simplest amongst the Reptilia. In a general sense it may be stated that the little left auricle receives the blood from the lungs, where it has been aerated and made to resemble bright arterial blood during the process of respiration, by means of the pulmonary veins. At the same time the larger right auricle receives the dark impure blood from the great veins (*venæ cavae*) of the body, head, and internal organs. The auricles thus diversely filled contract, and the pure and impure blood are forced into the single ventricle. The mixture is then partly expelled upwards into the muscular main artery to supply the body, and partly through a vessel into the lungs, to be re-aerated. The blood is cold, and the red blood-corpuscles are large.

The termination of the main artery into three or four arched trunks on either side relates to the method of respiration of the Amphibia. In some there are lungs within the body, the Frog being the common example; and in others there are external gills, or branchiæ, which last during the whole life of the animal, and the Siren is a well-known type. It is evident that a different distribution of the blood-vessels must occur in them. Moreover, in the Frog and others, like the Tritons, the young immature creature has gills and leads a fish-like life, but the adult has lungs only, so that a very considerable change in the organs of the circulation must occur in them during early life. Again, the branchiæ, or gills, are external in some, but in others they become internal, and the leaf-like gill seen outside is replaced by internal ones, supported by arched bony or gristly processes connected with the hyoid bone of the throat, and to which the water gains entry through clefts in the side of the neck. Each external gill and each of the internal kind supported on an arch of the hyoid bone, requires a branch of the main artery. When the branchiæ are in full action in the Tadpole, and the lungs are still rudimentary, the tympanic bone is greatly enlarged, and it forms the base on which the branchial apparatus is suspended by means of a thick angular portion. Between these angular portions and the median bone is a single piece, and two rhomboidal masses, to which are suspended the arches on which the branchiæ are supported, are attached to it behind, one on either side.

During growth the mandible, or lower jaw, increases in size, the tympanic bone relatively diminishes, the angular portions elongate, and a process of each, cartilaginous in its texture, is attached to the cranium. As the lung is developed and the branchiæ are absorbed, the separate parts of the apparatus behind the jaw are gradually fused in one, and the arches are lost.

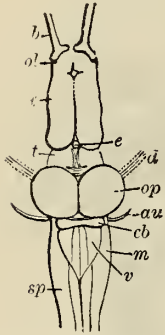
In their nervous system the Amphibia are intermediate between the Reptiles and Fish; and if



HEART OF FROG.

(a) Auricle; (v) Ventricle; (ao) Aortic Bulb; (1, 2, 3) the Aortic Trunks; (cg) Carotid Gland; (l) Lingual Artery; (c) Carotid Artery; (pc) Pulmo-Cutaneous Artery; (p) Pulmonary Artery, with ramifications over Lungs.

the brain and spinal cord of the Frog be taken as the type of the higher group, it may be said that the first is small. The front of the brain, or the region where the olfactory nerves arise, is a rounded swelling, and behind it are feebly-developed and rounded-off cerebral hemispheres, which contain cavities or ventricles. Behind is a space, in which is the pineal gland and the region of the optic thalami, and the optic lobes are distinct and in front of a band-like cerebellum. The medulla oblongata has a ventricle in it.



BRAIN OF FROG.

(b) Olfactory Nerves; (ol) Olfactory Swelling; (e) Cerebral Hemispheres; (t) Optic Thalami; (op) Optic Lobes; (e) Pineal Gland; (cb) Origin of Optic Nerves; (au) Auditory Nerves; (cb) Cerebellum; (v) Position of Fourth Ventricle; (m) Medulla Oblongata; (sp) Spinal Cord.

The spinal cord is long in some of the Amphibia, but it is not so in the Frog. The cranial nerves are small as a rule, as there is little expression in the Amphibia and the nerves of special sense are not highly developed. The eyes always exist, although they may be hidden beneath the skin, and they are very small in some kinds which inhabit subterranean waters or burrow in the earth. In those Amphibia in which the gills, or branchiæ, last through life or are perennial (*Perennibranchiata*), there are no eyelids, but they are found in some of the others. Nictitating membranes exist in some, and the Frogs and Toads have a special muscle which drags the eye farther within the orbit. All have simple organs of hearing, and in most there is a labyrinth and three semicircular canals, and there is a *fenestra ovalis*, and a gristly or cartilaginous auditory ossicle—the *columella*, or *stapes*, whose expanded end is fixed to the membrane of the *fenestra*. The worm-like kinds, the tailed Amphibia, and one group of the Batrachia (*Pelobatidæ*), have no tympanic cavity or membrane; but in other Batrachia they exist, and the outer end of the *stapes* is connected with the tympanic membrane, there being cavities opening into the throat also. The sound vibrations of the air or water are therefore conducted from the outer tympanic membrane, through the single *stapes* (not through three bones, as in the higher animals) to the internal ear.

In the adults of the Amphibia, the whole alimentary canal is of a very simple character. The œsophagus is wide and short; the stomach is single, and consists of a simple sac, which is globular in the land kinds, and is longer in the aquatic. The intestine is but slightly convoluted, and the large and small parts do not differ much in size. The liver, gall-bladder, pancreas, and spleen exist in all the Amphibia. An urinary bladder exists which opens into the vent, and the kidneys resemble those of fish more than those of higher Vertebrata, being persistent “Wolffian bodies” rather than true kidneys. These “bodies” are found with the kidneys in the young unborn Mammalia, but they are of no use after birth, and the kidneys act alone. They persist in the Amphibia and Fishes.

In the adult Frog, Toad, Salamander, and many others, the air is taken in by the lungs, not by the expansion of the chest by ribs and the consequent inrush of air to fill the space, as in the higher animals, but by a swallowing process resembling that of the Tortoise (p. 248). The inflation of the internal bag of the lung is produced by the creature first of all depressing its tongue and the hyoid bone, and thus enlarging the cavity of the mouth, so that air rushes into it through the nostrils, the mouth being shut. Then muscular contraction is exercised on the cavity and on the hyoid bone, so that the air is forced through the air-tubes into the lungs. The escape of air back again, by the nostrils, is prevented by their edges acting as a valve, and also by the tongue being pressed against them when it exists; and its entry by mistake into the œsophagus and stomach is prevented by closure of the gullet spasmodically. Hence the way to suffocate a Frog is to place something in its mouth which will keep the jaws apart, so that the air escapes and does not go into the lungs. The primary necessity for this Tortoise-like breathing is from the absence of perfect and sternal ribs.

In the case of the Amphibia with branchiæ, or gills, the water, in passing over them, carries air with it, and the oxygen in it is devoted to purifying the blood. But although these two kinds of respiration are explicable, there is a difficulty in explaining the use of the rudimentary lungs in those Amphibia which never shed their branchiæ, such as the Siren and the Proteus. The construction of their nostrils resembles those of fish, and the lungs are thin and extremely delicate; moreover, they are contracted near the gullet. Indeed, it does not appear that when the Siren is dying from having impure water acting on its branchiæ, that the lungs assist in the least in respiration. Bell long since considered these bag-like “lungs” to be similar organs to certain air-bags in fish, which will be

explained in treating of that group, and which have been considered to foreshadow the lungs of the higher animals.

The existing Amphibia are classified in three great groups or orders. In one there is no tail present in the perfect animal, although it is present in the tadpole or immature state. These are called the ANOURA, or Tailless Batrachia, and they are the Frogs and Toads.

The next group contains the Amphibia, which have tails throughout their whole life. These are the URODELA, and they are subdivided into those which have either the branchiæ (or gills), or else gill-clefts, external throughout life—the Ichthyoidea; and into those which have neither branchiæ nor gill-clefts in adult age—the Salamandrinæ. The third order is that of the legless Amphibia, which are called APODA. The Salamandrinæ have the vertebræ concave behind, and eyelids, and the other group of the Urodela has biconcave vertebræ and no eyelids.

THE ORDER ANOURA.—THE FROGS AND TOADS.—THE TAILLESS BATRACHIANS.

The Tailless Batrachians, or the Batrachians proper, or the Frogs and Toads, have a broad head, largest behind, and a broad short body in the perfect state, and four legs, the hinder pair being the stronger, and longer than the others, and specially suited for leaping, swimming, or burrowing. Some climb, and then usually there is not a web between their fore toes, the extremities of which, and of the hind ones also, are dilated into round discs. But the degree of the development of the web of the fore and hind extremities refers to the power of swimming. Hence, it is not always found, and its size varies. Almost all undergo a visible metamorphosis, that is to say, they have a tadpole condition in water, and change to an adult, terrestrial, and different form.

They are found in damp places, or in the neighbourhood of water, and those living in temperate climates hibernate during the winter by getting down cracks into earth, or in the mud on the floor of ponds; whilst those living in the tropics, remote from water, bury themselves deep enough in the ground to escape the hot dry atmosphere. In both cases a lethargic condition prevails, until a change of season.

Their lungs consist of two large sacs, which may be expanded until the animal attains nearly twice its usual size. When they dive, the lungs are emptied of air, and the respiration will cease for a couple of hours, after which time a rise to the surface, to take in air, is requisite. But during the summer and winter state of existence the respiration is suspended at the same time that all the other functions—circulation and digestion, for instance—are very low, or cease.

Many males are provided with one or two membranous throat or mouth sacs, and when there are two, one is placed on each side of the mandible; and if there is but one, it is found between its branches. In either case the sac opens into the cavity of the mouth, by two slits, and is filled with air from the lungs. These sacs enable, by their contraction, a more or less loud noise to be produced. The males are often distinguished by a rough swelling on their thumbs, or by short conical spurs there, and, as a rule, they are more slender than the females.

There is usually a mass of glands, called the parotids, above the tympanum on each side of the neck. The skin of the body and limbs is not covered with scales or plates, and is naked and coloured.

The food consists of insects, slugs, and worms, and some very large kinds snap up small vertebrata. They seize their prey with their tongue, and draw the victim into the mouth as this organ is retracted.

Teeth are not found in the lower jaw, and only a few have a pair of tooth-like prominences near the chin. On the other hand, the upper jaw and vomer are very frequently armed with a series of simple teeth, which in the largest species assist in capturing food. There is no mastication possible, and the prey is swallowed entire.

On leaving the egg, the larval or tadpole state commences, and the creature has external gills for a short time; then the gills become internal, and this immature condition lasts about 100 days, and during that time the internal anatomy and physiology greatly resemble those of fish.

They eat during the tadpole state, living on decaying water-plants and decomposing animal matter, and as they breathe by gills, they have, when young, three, and usually four, gristly or more or less bony gill supports, called branchial arches.

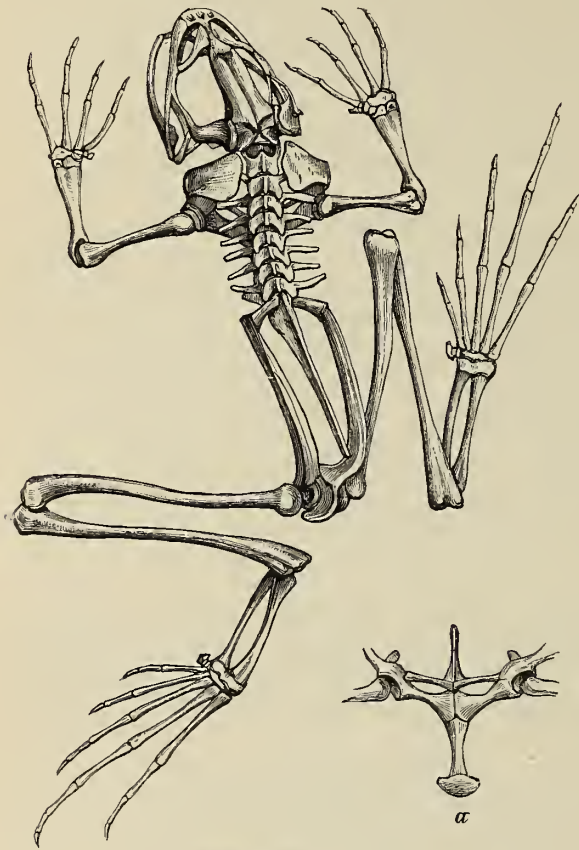
The bodies of the vertebræ in most of the adults are concave in front and rounded behind (pro-cœlous), with the exception of the eighth, or pre-sacral, which is amphicœlous, and the ninth, or sacral, which has commonly one convexity in front and two behind. The vertebræ in front of the sacrum are never more than nine, and the tail part is in the form of a bony style, with two rounded arches.

The vertebræ are opisthocœlous, or hollow behind, in the genera *Pipa* and *Bombinator*; and in these, as in all other Amphibia, the bodies and inter-vertebral substances contain more or less distinct remains of the notochord. A sacral vertebra always exists, and its transverse process, and those of the vertebræ in front and behind, with which it is anchylosed, are large and usually expanded.

The shoulder-girdle consists of, in the Frog, for instance, the shoulder-blade (in two movable pieces), the collar-bone, and the coracoid bone, and all these combine to form the joint cavity for the humerus. The collar-bone is connected with its fellow of the other side at the median line of the body, and the broader and larger coracoid meets its fellow also. The sternum consists of several pieces which extend from the front, anterior to the collar bones, to well behind the coracoids, where it ends in a broad cartilage. The front part is formed by the episternum. There are no ribs.

As the fore limbs are not of the importance of the hinder, the humerus is small, short, thick, and has almost a globular surface for the articulation of the bones of the fore arm. These are united in one. The wrist bones are six in number, and support four metacarpal bones, and the index and middle fingers have two phalanges each, and the others three. The thumb is small and rudimentary.

The bones of the well-developed pelvis present considerable differences in the various genera. Thus, in the Frogs (*Rana*), and



SKELETON OF A FROG.

(a) Sternum, &c.

the Tree Frogs (*Hyla*), the iliac bones are very long, and are movable on the sacrum; and they are very close together below, towards the joints for the long thigh bones, so that the two heads of these bones seem to be placed in contact. This peculiar arrangement influences the action of the hind limbs upon the trunk in the exertion of swimming and leaping. In the *Pipa*, or Surinam Toad, the iliac bones are very much widened at the point of junction with the sacrum, to which they are fixed, and which is itself dilated. The bones of the leg (*tibia* and *fibula*) are, in the Reptiles, generally distinct; but in the Frogs and their allies they are so soldered together as to form but a single articulation with the femur and tarsus, and to present the appearance of a single, very much elongated, bone. The knee-joint and articulating bones are so disposed that the feet have always a direction outwards.

The united leg bones are longer than the femur, and are followed by very long astragalus and calcaneum bones. Four small ankle bones exist, and the metatarsal bones and phalanges are very long, as they have to support the web when it exists, and to assist in swimming and jumping. The inner toe is well developed, and the fourth is the longest.

It is remarkable that the muscles of the abdomen should be more developed in these Anoura than

in the Reptiles, and that they should present, in this particular, some analogy to the abdominal structure of the Mammalia. But it is in the disposition of the muscles of the thigh and leg in the Batrachia that the greatest singularity is manifested. These, whether taken conjointly or singly, present the greatest analogy with the muscular arrangement of the same parts in man. There is a rounded, elongated, conical thigh, the knee extending itself in the same direction with the thigh bone, and a well-fashioned calf to the leg.

The locomotion of the Batrachians on the land consists in walking, running, and leaping, the last being the most prevalent motion. The greater part of them are excellent swimmers; and when they betake themselves to this exercise the body is extended horizontally, and the animal is propelled by the mechanism of the lower extremities alone. It is impossible to watch the horizontal motions of a Frog in the water, as it is impelled by these muscles and its webbed feet, without being struck with the great resemblance, in this position, of its frame to human conformation, and the almost perfect identity of the movements of its lower extremities with those of a man making the same efforts in the same situation. By the aid of these well-developed lower limbs, and the prodigious power of their muscular and bony levers, some Frogs can raise themselves in the air to twenty times their own height, and traverse, at a single bound, a space more than fifty times the length of their own bodies.

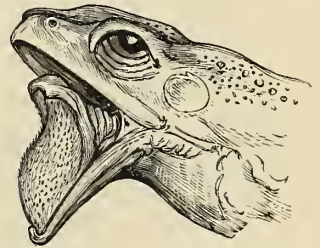
The tongue performs a leading part in the capture and deglutition of the prey. It is very soft and fleshy, and is not supported at its base by an os hyoides, as in the other Vertebrata, but it is fixed in the concavity which is formed by the approach of the two branches of the lower jaw towards the chin. In a state of repose, and when the mouth is shut, this tongue, which has its root, so to speak, in front, has its free extremity or tip in the back part of the mouth, and before the aperture of the air-passages; but when the animal puts it out, the lower surface comes upwards and the tip reaches far beyond the mouth. The tongue is armed with a tenacious, viscous secretion, and when it touches the prey this adheres so firmly to it, that it is carried back with the tongue into the mouth. All this is done with a rapidity which the eye can hardly follow. The noises, produced by the expulsion of air, vary from the well-known croaking of the Common Frog to the bellowing of the Bull Frog, and the shrill trebles of the males of the species of the Tree Frog. They, and the flute-like and metallic sounds occasionally given out, and the sort of seemingly ventriloquous grumbling which some species of Toads exert, are vocal sounds emitted above the larynx, from the mouth, or from some of the membranous sacs.

The croakings, produced by the throat bags, seem intended to make the one sex sensible of the presence of the other. Thus the Green Frog has two cheek-pouches, which are inflated by the animal in the breeding season by means of two apertures close to the end of the great air-tube of the throat; and the folds of the larynx, called chordæ vocales, are very large and distinct in many species. The glottis bears, apparently, considerable analogy to the upper larynx in birds.

The naked skin of the Frogs, and, indeed, of the Batrachians generally, has the power of acting in such a way as to fulfil in a great degree the functions of the lungs, and aerated water may be made subservient to this cutaneous respiration. This has been proved by experiments made on Frogs which have been kept in vessels, and under water charged with air, renewed from time to time, and on Toads which have been kept alive for months in nets sunk under running water, at a low temperature, without any direct access to atmospheric air.

The spawn seen in water in the spring time is a mass of semi-transparent, gelatinous, round bodies, with little dark-coloured specks inside each. From these are developed the larvæ, or Tadpoles.

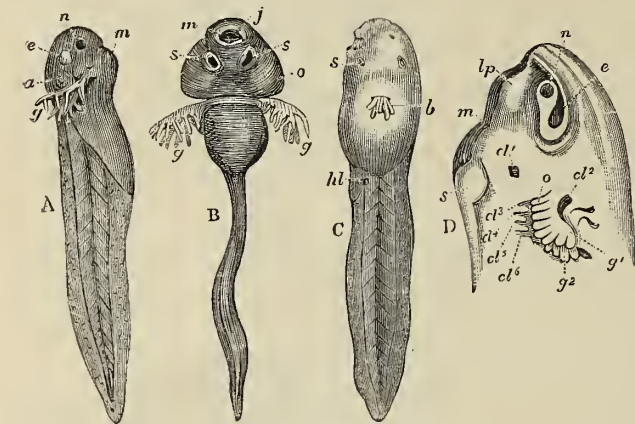
Commencing like aquatic animals, the larvæ of the Frog, and other Tadpoles, exist very much after the fashion of fishes, moving and breathing like them, and resembling them in shape, on account of the long flat tail. As time elapses, under the influence of warmth and food, the growth does not take place in a manner which will simply enlarge the animal, but it produces alterations in the outside form,



HEAD OF FROG (*Phyllomedusa*), SHOWING TONGUE FIXED IN FRONT BUT FREE BEHIND.

in the method and structure of respiration and circulation, and also in the organs of motion, special sense, and digestion. So that during the earlier lifetime, an incomplete and altogether differently-shaped creature is being perfected into a permanent adult form. This process is called metamorphosis. In the early days of Tadpole life much of the organisation (circulation and respiration) is very like that of the fish, for the simple heart of these last is furnished to the little things. There are minute thread-like gill-fringes, or branchiæ, just behind the head, and they only require a heart which will supply them—a single or branchial heart. But as growth proceeds, the branchiæ become hidden in a cavity, and then are absorbed, the lungs growing within, and a heart which has a double nature, and which relates to the body and also to the lungs, being systemic and pulmonic,

is gradually developed. The limbs are at first scarcely perceptible, and become gradually developed, passing through a rudimentary stage beneath the skin, from which they do not emerge until they have attained considerable size and a definite shape. The hind legs appear first, and they are soon employed to assist in a feeble manner the strong and active tail in moving about. The tail is developed to a great degree, and it is made up of muscles surrounding vertebræ, which form a long column, but they are not ossified (in those Amphibia in which the tail persists the vertebræ are ossified early). As weeks pass on the limbs grow, and the tail diminishes by absorption, and gets smaller and smaller, until it disappears. It does not drop off, but



STRUCTURE OF THE TADPOLE.

(A) Side View, showing Gills, *g*; Mouth, *m*; Nasal Sac, *n*; Eye, *e*; Ear, *a*; (B) from below, *ss*, Suckers; *o*, Operculum; *j*, Horny Jaws; (C) More advanced Tadpole, showing growth of Operculum, so as to enclose Gills, save at opening *b* on left side; *hl*, rudiment of hind limbs; *s*, Sucker; (D) Head of young Tadpole (magnified); *g*₁ *g*₂, external Gills; *lp*, Upper Lip; *cl*¹ to *cl*⁶, Clefts.

its substance is received grain by grain into the adult animal. The skull, very cartilaginous at first, becomes consolidated and bony to a considerable extent, and thus is more reptilian than fish-like.

The branchiæ at first appear in about fifty hours, when the temperature is warm, as small projections, and shortly afterwards a "holder," appears on either side of the future mouth. Before the fourth day in hot places, and in England not for a month, it emerges, jerks itself about, and breaks out of the egg a free swimmer.

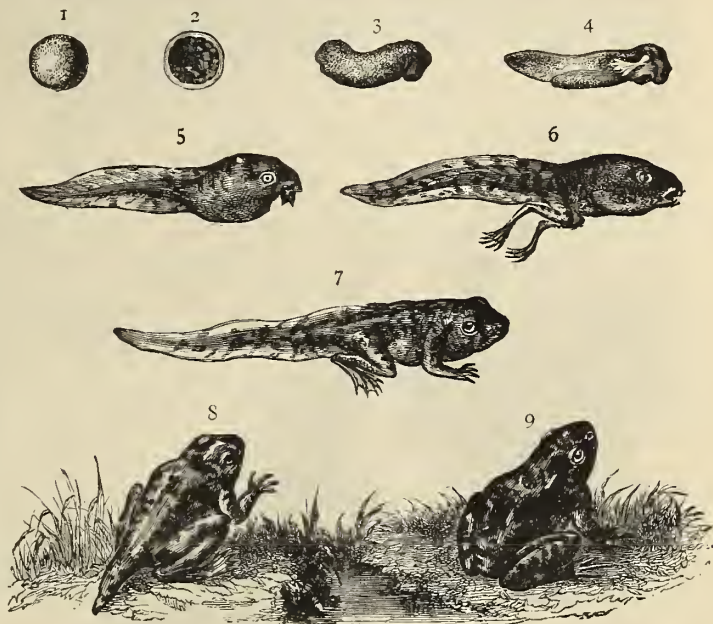
The branchiæ consist of two principal divisions, or branches, from each of which proceed four or five leaf-like processes subdivided into numerous little filiform leaflets regular in shape, and forming the ultimate divisions of the structure. On these ramify the minute capillary blood-vessels, and the blood undergoes its change there, being oxygenated, and evolves carbonic acid gas. A minute branch of an artery conveys the impure blood from the heart and enters each leaflet at its base, and passes along its shorter or inner margin, giving off capillary branches in its course, which, after meandering over the surface of the leaflets, and communicating with each other in various directions, pass over to the opposite side, and join and form a branchial vein. This unites with others at the base of the leaflets, and thus a vessel is formed which takes the purified blood to the heart.

In this stage the circulation of the blood may be seen, under the microscope, to perfection in the gills. The current of the blood passes up each stem of the branch, and a distinct stream is given off to each leaf. It is propelled to the end, and returns down the opposite sides by the veins. Every blood corpuscle—red and white—is visible, and they move in the transparent vessels with singular regularity. As growth proceeds the branchiæ become fully developed, and then they begin to diminish in size, become obtuse, and are gradually so reduced as to be withdrawn within the branchial cavity, and concealed by a little cover, or operculum, of the integument. It must be noticed that as soon as the true Tadpole shape is assumed, and the branchiæ are within their cavity, and in communication with the outside through certain slits in the neck, they are supplied with water, which enters the

mouth by the nostrils which are supplied with valves. When in the mouth, which is closed on all sides, with the exception of the throat, where are the gill or branchial slits, the water, acted upon by the muscles which cover them, traverses their spaces, and bathes the branchiæ, before its exit through the slits.

The eyes are perfectly formed at this time, and the mouth has changed its position from below to the extremity of the head. It is very small, and there are no teeth, but minute horny plates are on the jaws, and sufficiently strong to tear the soft animal and vegetable substances which form the food. The Tadpole has a digestive system, the stomach being succeeded by an intestine which is of nearly equal size throughout its length, which is great. It is at least ten times as long as the inside of the body, and is curled up in a coil, and it occupies most of the abdominal cavity. During the growth of the Tadpole, and its change into the perfect Frog or Toad, it becomes shorter in proportion to the length of the animal, until at last it is not one-quarter of its original length.

The tail soon becomes developed sufficiently to move, and to move its possessor, and the colour of the body changes, becoming a soft olive-green instead of black, the abdomen being dotted with golden-yellow. The external form thus altered remains for some time, and the rudiments of the hind limbs



METAMORPHOSES OF FROG.

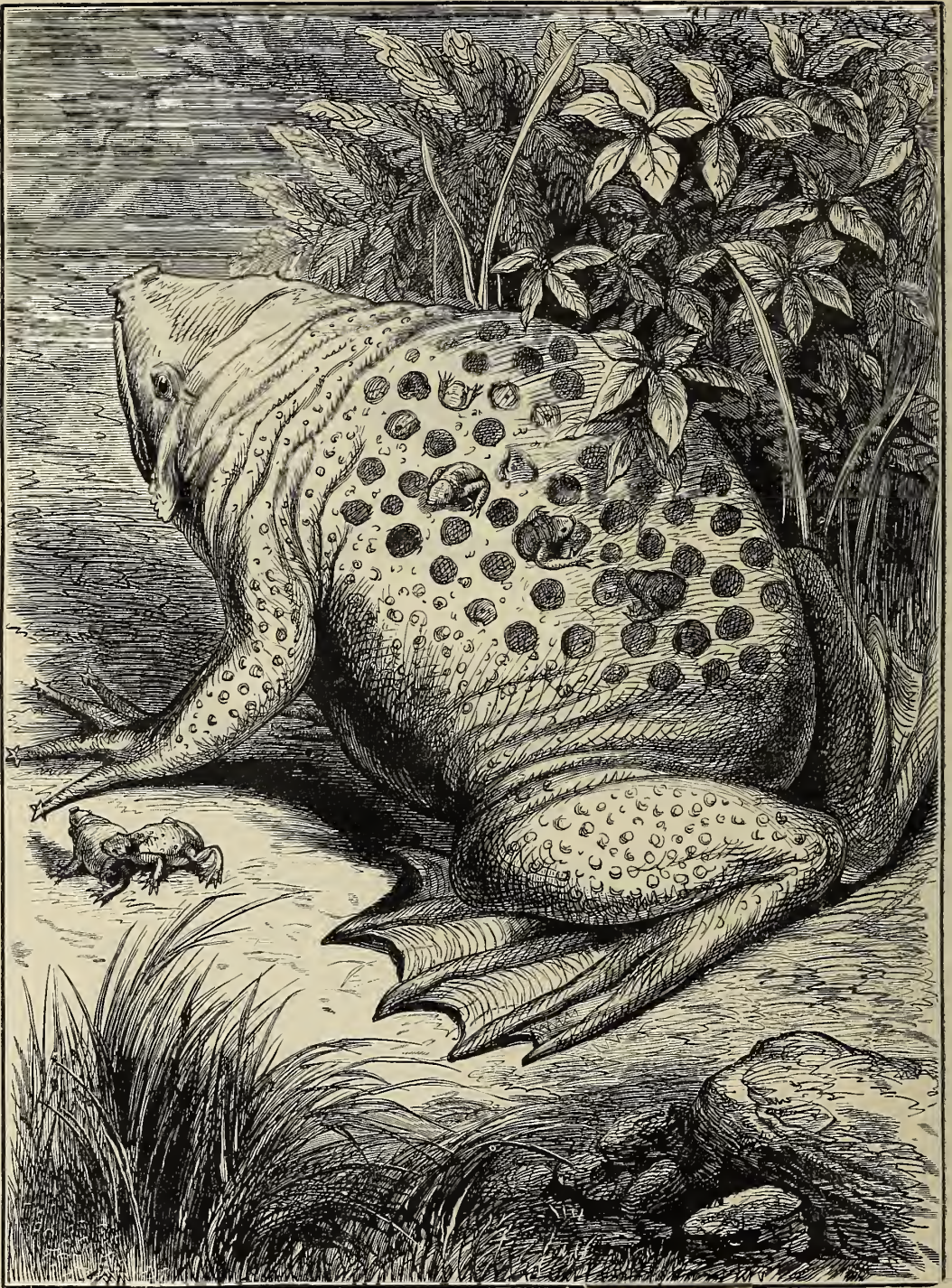
(1) Egg of Frog; (2) Egg Fecundated, and surrounded by its Vesicle; (3) First state of Tadpole; (4) Appearance of Breathing Gills; (5) Stage with Internal Gill; (6) Formation of Hind Feet; (7) Formation of Fore Feet and Decay of Gills; (8) Development of Lungs and Reduction of Tail; (9) Perfect Frog.

appear, the toes budding at their extremities. Soon the fore limbs do the same. Then, as the hinder limbs increase, the tail is removed by absorption, which begins at the tip. When the branchiæ have ceased their function, and lungs have developed, the creature is tail-less, and having long hind legs, comes to land, for it has become capable of respiring air with its lungs, and of hopping and jumping to search after small insects and worms. As growth proceeds, the webs to the digits, barely visible at first, become important structures, and the colour, glands, and ornamentation of the skin are noticed. Such multitudes, writes Bell, have been found in damp weather as to have given rise to many a story of its having rained Frogs. They now grow rapidly, until the approach of winter causes them to seek a retreat for hibernation. Bell states that so numerous are the enemies of the Tadpoles and young Frogs in the form of birds, fish, reptiles, and the smaller carnivora, that not one in a thousand survives. It is some time before the adult condition is reached, for Batrachia grow for several years, and then may be said to be perfect.

THE AGLOSSA (THE BATRACHIANS WITHOUT TONGUES).

The first sub-order of the Anoura contains those which have not a tongue. They are large, flat, ugly creatures with the eyes placed far forwards and close to the sides of the mouth, and their tympanum is concealed. All have the hind feet with a perfect web between the toes, and they live in hot countries, having a remarkable geographical distribution. There are three families of them.

The Surinam Toad, which was first noticed by Sibilla von Merian, in 1708, and which is a flat toad-like creature with a short, broad, and pointed head, huge hind limbs with webbed



THE SURINAM TOAD. (*Pipa americana*.)

feet, and small fore limbs with four slender webless fingers curiously ending in four small projections, sometimes grows to a length of nearly a foot. It has a blackish-brown body, and is a native of Surinam and of the neighbouring parts of South America. Living a monotonous life, apparently on land at the edges of the swamps and plantation ditches, and amongst buildings, this *Pipa americana*,

the representative of the family of Pipidæ, has neither tongue nor teeth on the jaws and palate. Besides being huge and curiously made, it is very remarkable, for there is a portion of its life-history which is very extraordinary. The back of the female is covered with soft skin, which overlies a great lymphatic space, and in the breeding-season it develops cavities and ridges, and each of these separate compartments contains a young Pipa undergoing its metamorphosis. It is very evident that each of these cavities, which give the back a honeycombed appearance, has contained an egg, and the question is how did the egg get into this extraordinary position. Certainly it would not be deposited there by the mother, and equally certainly there is no passage from the egg-producing structures in her body to the cavities. It is said that as soon as the female lays her spawn the male places it in the cavities in the back of the female, and the eggs form little pits by their pressure on the skin. Probably this takes place in the water. Firmin states that the female lays her eggs in sand, and that the male clasps them between his hind feet, and then jumps on to the mother and disperses them over her back. She then goes into the water, and the eggs are hatched there, and the tadpole state is passed through in the cavities, so that in eighty-two days sixty or seventy young ones poke out their heads and limbs and jump off as perfect Pipas, the mother having returned to land. Then the female retires to a stony or reedy retreat in water, and changes the skin of her back. How much of this is true is not quite known.

The second family, the Dactylethridæ, has a species in Africa, but it is more Frog than Toad-like in shape. The upper jaws and intermaxillaries have teeth, and the three inner toes of the long feet have claws. The species is *Dactylethra capensis*.

Australia contains the other family, the Myobatrachidæ, and in the species *Myobatrachus paradoxus* there are two large teeth in the intermaxillary bones, and the passages from the ear to the throat, or the Eustachian tubes, enter the gullet separately, and do not form a common canal, as in the other families. Very little is known about their habits.

THE BATRACHIANS WITH TONGUES.

The second division, or sub-order, the Phaneroglossa, are the Anoura with tongues, and there are two groups of them—the Oxydactyla, which have pointed tips to their digits and toes, and the Discodactyla, which have discs to them ; and these are divided into families.

THE OXYDACTYLA.—FAMILY RANIDÆ.

The True Frogs, the *Ranidæ*, form the first family, and they have a slender and longish body, very long hind feet and limbs, with the long hinder toes united by a web. The upper jaw, intermaxillaries, and vomer have small curved teeth, which are rarely seen on the mandible. The skin is smooth and the tympanum is visible, and the pupil of the eye is round or transverse. The Common Frog,* the type of the family, is of a greenish-brown, yellowish, or reddish colour, with an oblong brown spot behind the eyes, and the legs have brown cross-bars. It is, as is well known, found in almost all parts of Great Britain, wherever there is a river or pond, or even sufficient shade to maintain the degree of moisture necessary to preserve the skin in a condition in which it may assist in the respiration of the animal. They have been in Ireland since the beginning of the eighteenth century, and probably they were artificially introduced, and became acclimatised. The Frog feeds sometimes with eagerness, and captures with its rapid tongue many kinds of insects, beetles, and slugs, and is an excellent friend to the gardener. They assemble together in the spring, when they croak in chorus, and the sound has often a very peculiar effect on a still evening ; and as cold weather comes on they sink themselves in the mud under the water, and Bell says often in multitudes, which are found embracing each other in a torpid state. In the spring they come forth, and the egg-laying soon begins, and the Tadpole, whose life has already been noticed, turns in due time to a creature like its parent. The deposit of eggs takes place at the bottom of the water, and the mother cares nothing about them in future. She and the male are surrounded by a host of enemies, and snakes, birds, small animals, and fish, are constantly looking out for them. The male is smaller than the female, and the extreme length is about two inches and three lines from the snout to the hinder

* *Rana temporaria*.

extremity. On the whole, the Common Frog is not an extreme frequenter of water, except during the egg-laying season.

Bell tells a story of a domesticated Frog, who came at meal-time, and snuggled up to the cat in cold weather; but it must have been an exceptional Frog. Usually they can be made not to fear their kind feeder, but the rising generation tease them and enjoy their prodigious jumps. Fishermen use them as bait for pike, and physiologists show the circulation of the blood in the web of the foot, and Mattéuchi discovered a special galvanic energy in batteries made up of their thighs, so that, on the whole, the Common Frog has little to thank humanity for. Dr. Bell states that a large *Rana* has been found in Scotland, but it is not decided whether it is a variety of the Common Frog or a new species. The web of the foot forms a beautiful microscopic object, and the circulation of the large oval blood corpuscles, and the white or colourless corpuscles, can be seen in it. The species and its varieties have a great geographical distribution.

The development of the Tadpole into the Frog has been already described, and it is merely necessary to observe that the masses of eggs, or spawn, when first expelled, consist of numerous small opaque globular bodies covered with a glairy substance. This absorbs a large quantity of water, and soon increases in diameter; so that the black specks, the future Tadpoles, are separated by the glairy envelope one from another. The development of the young is more or less rapid, according to the temperature. The embryo is at first a small spherical body, one side being dark brown and the other paler. A furrow grows across the dark half, dividing it into two equal parts, and this is soon afterwards crossed by another at right angles. A third and fourth furrow are produced and so on, until the sphere is separated into as many granules. In the course of the



THE COMMON FROG.

second day the sphere begins to elongate, and a groove, which had previously divided the upper part into two, begins to close up, and the head becomes prominent, the tail begins to show itself, and the little hooks, by which it subsequently lays hold of things, begin to appear. In somewhat more than fifty hours the head becomes well marked, the membrane of the tail is seen, and the first indications of branchiæ occur on each side of the head. Moreover, the muscles of the spine may be seen. The whole creature grows, and these parts become more distinct, and the branchiæ consist of two tubercles on each side, and as yet are undivided. The young creature now will give some signs of voluntary movement, and the nostrils are seen, but the mouth is scarcely observable. The eyes are just visible. The next stage is a division of the branchiæ into lobes, and the blood may be seen circulating in them. The embryo is still restricted to a curved position by the substance round it, and it may be seen to jerk itself about until it escapes. Bell says that although all this may be done in the warm waters of the South of Europe, or in artificial water at a temperature of 73° 4 Fahr. in four days, it takes at least a month in our cold climate. The rest of the metamorphosis has been described in explaining the general peculiarities of the Amphibia (p. 348). When the metamorphosis is completed, and the little Frog has received its permanent shape, the skin gradually becomes coloured, and, according to the light, the prevailing colours of the surrounding objects, the health of the creature, and possibly from nervous influences, the tints change, the mobility of the colour corpuscles within the skin being the cause. It appears that the skin of the Frog, when kept damp, plays an important part in the elimination of carbonic acid gas, and also in the absorption of oxygen from water, and probably from air; for experiments have shown that the lungs are not sufficient to carry out the respiratory process perfectly, so that the skin must be utilised. Bell believes that during the damp condition of the skin water is absorbed and stored in a sac which acts as if it were a urinary bladder. This store he considers is kept to moisten the skin when it requires it for the purpose of respiration. It is re-absorbed and deposited in the skin.

In vertebrate animals the bones may be formed with a groundwork of cartilage, in which osseous grains are gradually deposited, and such are cartilage bones. Others have no cartilage, but the bone is deposited in a membranous tissue, and such are membrane bones, of which the parietal or frontal bones of the mammalia are examples. Huxley states that in the higher vertebrates the cartilage bones rarely remain as such, but the ossified cartilage becomes absorbed and is replaced by a membrane bone derived from the investing tissue.

The Frog's skull is characterised by a cartilage bone called by Cuvier the *os en ceinture*, or girdle-bone. "It is an ossification which invades the whole circumference of the cranium in the pre-sphenoidal and ethmoidal regions, and eventually assumes somewhat the form of a dice-box, with one-half of its cavity divided by a longitudinal partition. The septum and the front and back halves of the bone correspond to the ethmoid pre-frontals, and the orbito-sphenoids of the other vertebrata." (Huxley.)

The Edible Frog,* found and used as an article of food in many parts of the Continent, is also an inhabitant of this country. It can be readily distinguished by the absence of the large distinct black mark on the side of the head to the shoulder, seen in the Common Frog, and by the presence of a light-coloured line running down the back, and by its marking with round circumscribed spots. The thumb has two large tubercles on it in the male, whose vocal sacs are large and globular. Mr. Bond found them in Foulmere Fen, Cambridgeshire, and observed that their croaking was different from that of the Common Frog, the sound being like a loud snore. It is a timid animal, disappearing on the least alarm, seems to come rarely, if ever, to land, and is essentially a dweller in the water. It inhabits running or still waters, rivers, streams, lakes, ponds, salt or fresh marshes, and even ditches, and it may be seen sunning itself on a water-lily leaf, and rarely on the banks. The slightest noise alarms them, and they rush to the water. Their remarkable croak has procured them the title of Cambridge Nightingales. When this is going on the male blows out his sacs, which appear on each side of the head. This description holds good for the Continental Esculent Frogs. The hind legs are the parts which are to be cooked, and in spite of our national antipathy, there is no doubt that they are very nice when well cooked and served, for they taste like the most delicate spring chicken.

The genus *Rana* is well developed in America, and the American Bull Frog is well known (*Rana*

* *Rana esculenta*.

pipiens vel mugiens). It has a large head, green above and yellowish-white below. The body is large, green in front, dusky-olive behind, and has irregular black blotches. The under parts are yellowish-white, and the limbs are dusky, with black bars. The iris is of a beautiful golden colour with black marks, and the tympanum is large and is bronzed. It reaches from thirteen to twenty-one inches in



THE EDIBLE FROG.

length, limbs included. They are very active and leap to a great distance, and yet it is a very aquatic Frog, and they will live in the water for years. Sluggish rivers and stagnant ponds are their delight, and except in the breeding season, they are solitary. Then they collect in hundreds, and their croak is very loud, and they may be heard half a mile off. When taking the water they skim along the surface at first. Insects, small crustacea, and snails are their food, and they are found in every part of the United States, and as far north as Quebec.

There are none of these True Frogs in Australia, or in the Islands of the Pacific.

Amongst the not very numerous East Indian species of the genus *Rana* is Kuhl's Frog,* with a large web to its feet. It lives in Ceylon, Java, Celebes, and in China. The lower jaw has a pair of fang-like prominences in front. The Indian Bull Frog† has the web broad, notched, and it does not extend to the extremity of the fourth toe. It is common over the whole of Hindostan, and is found also in Ceylon, Sikkim, the Malayan Peninsula, China, and the Islands of the Archipelago. Some measure six or seven inches in length. The young are very small. They abound, and when they are frightened they jump over the surface of the water much in the same manner as they do on land. Dr. Günther has described the Edible Frog‡ from Ningpo, and thus its distribution is not only in every part of Europe and in North Africa, but also in Central Asia to China and Japan. A Frog closely



CYSTIGNATHUS ORNATUS.

resembling the English *Rana temporaria*, but having larger limbs, is found in Japan and in the neighbourhood of Ningpo; and it is even allied in shape to *Rana sibirica* of Lecomte, from North America.

With regard to the African Frogs, there are two sharp-headed, slender-bodied, long-limbed, beautifully-marked Frogs, which have been described from South Africa by Dr. A. Smith. One, Delaland's Frog, is common everywhere, and especially near Cape Town. It is generally observed on dry ground, but readily takes to water when alarmed or pursued. The other inhabits Kaffir Land and Port Natal, and is about four inches and three-quarters long, and is called *Rana oxyrhynchus*. A sprawling, long-legged, stupid Frog is *Rana fuscata*; it has great toes and long legs, and is about one inch and a half long. It is widely spread over South Africa, inhabits damp localities, leaps freely and for considerable distances.

One Frog is fished for, with fish-hooks baited with flesh, in Southern Africa, and it is common near Cape Town. It is *Rana fuscigula*.

The Frogs of the genus *Pyxicephalus* are found in South Africa and India. All have the fingers quite free, the toes incompletely webbed, and the head thick, rounded, and swollen behind. The vomerine teeth are in two oblique series, and the tongue is large, free, and deeply notched behind. The metatarsus has a flat, sharp-edged shovel-like prominence. One species is found in Hindostan and in the Himalayas, and with the aid of its shovel-like metatarsal it burrows in the ground to a depth of one foot and a half.

One of these is called The Bull Frog, in South Africa, from the strength and hoarseness of the sounds it emits, particularly during the night. It lives generally in water, and is only seen in it

* *Rana Kuhlii*.† *Rana tigrina*.‡ *Rana esculenta*.



THE HORNED CERATOPHRYS.

or in its vicinity. Dr. Andrew Smith saw many in water, where at other seasons none existed, and the probabilities are that they bury themselves during the dry season. They are beautiful Frogs, five inches and a half in length, and their green, brown, and red tints, and pretty eyes, make them very picturesque.

Some species of the family of the True Frogs have no teeth on the vomer, and they belong to the genus *Oxyglossus*. A species lives in Java, and some fossil kinds, which are found in the so-called Frog-beds of Bombay, are of an early Tertiary age.

The Jakie* is a greenish Frog spotted with brown, and has irregular linear markings of a brown tint along its thighs and legs. It is from Guiana, and is said to have the largest Tadpole of all the Frogs. So large, relatively, is this larval form, that when the tail is absorbed no increase of growth in the adult occurs.

A large Frog, with the upper eyelids ending in a kind of triangular horn, from each of which a ridge runs down the sides and back to above the hinder extremity, is sometimes thirty-five lines long. It belongs to the genus *Ceratophrys*.† It is a Brazilian kind, and little is known about its life. Mimetic, as it were, of this curious Frog is a genus whose species have also the upper eyelids prolonged, and which have a broad and short body. The skull is marked with long ridges; there are folds of skin on the neck, and the limbs are of moderate length, the toes being distinctly but shortly webbed. The iris is a golden-brown, and the pupil is vertically rhomboidal. The body is much blotched with white and black, and there are two species. One has a prominence on the skull,‡ and lives in Borneo, Malacca, and Sumatra, and the other, without the structure,§ is restricted to Java and Ceylon. They have the tympanum hidden, and really belong to a small sub-family, of which the Painted *Discoglossus* of the countries bordering on the Mediterranean is the type. They have the tongue almost circular in outline.

A beautiful little Frog with a body about one inch and a quarter long, having a small head and a short and thick body, is of a dove-colour above, and is exquisitely marked with oblong spots and bars of dark brown margined with yellow. It has a small mouth, and the palate is armed with two groups of exceedingly minute teeth between the posterior nostrils. It has pretty eyes, and the lower surface is silvery white. It is a South Carolina Frog, and takes to the dry cornfields, and appears to like land, and, indeed, Holbrook states that one thrown into the water did not know how to swim. It has not the web on the hind feet, and in this it resembles some South American and West Indian species, nor has it parotid glands. They all belong to the genus *Cystignathus*. It forms a sub-family.

The second family of the *Oxydactyles* is called the *PELOBATIDÆ*, and it contains some kinds which are to a certain extent intermediate between the Frogs and Toads. They have the skin more or less warty or glandular. The body is plump and squat, but the upper jaw has teeth. Usually the membrane of the tympanum and its cavity are deficient, and the pupil is often vertical. They lay their eggs in strings like the Toads, and most of them are terrestrial, and make holes and burrows in the earth, only seeking the water during the egg-laying season.

The first example|| is of one which has a distinct tympanum and a small parotid gland, but it has no vocal sac. It has short limbs and large glands around the ears. The toes have half webs, and it is grey in colour with spots. It is remarkable for boring long burrows, and for the curious practice of the male, which has a very sonorous voice, of assisting the female to get rid of her eggs. These are large and in strings, and he attaches them to his thighs with a glutinous secretion. He buries himself until the eyes of the little Tadpoles can be seen beneath their envelope, and shortly afterwards he seeks a stagnant pool and plunges in. The Tadpoles soon burst forth and swim away. It is a small Frog, and is to be found in the environs of Paris.

Another kind has webs to its hind feet. The tympanum and its cavity are deficient, and the tongue



THE MALE OBSTETRIC FROG.

* *Pseudis paradoxa*.

† *Ceratophrys cornuta*.

‡ *Megalophrys nasuta*.

§ *Megalophrys montana*.

|| *Alytes obstetricans*.

is fixed. It jumps and swims nearly as well as the True Frogs, and has a warty body with a dirty green tint above, and the belly fiery red and spotted with blue. It is called the Fire-bellied Toad, and has a fine sonorous voice, and the cry is *ouvk, ouvk*.* The larvæ are large; it is a dweller in marshes, and is an European kind.

The genus *Pelobates* is the last of this family to be noticed, and it has species in France. They are fine Frogs, having the tongue free behind, but scarcely notched. They have no tympanum, and the arms have a special gland and the hind feet a sharp swelling. The web is complete in the feet.



THE FIRE-BELLIED FROG.

One is grey-brown in colour;† smells like onions, and jumps like a Frog, and makes holes and burrows in the mud with its hind limbs. It has a loud cry of *ouk*, and the metamorphosis of the very large Tadpoles lasts a long time.

The Globose Cacopus Frog is worthy of its name, and is found in the Madras Presidency. The head is very short, and so are the limbs, and the mouth is small; the body is bulged out in a globular form, and the limbs and toes are short and slightly webbed. It has a small eye with a round pupil, and the skin is smooth, brown, and black on the tail. They have a circular tongue. Dr. Günther states that he has seen two specimens of this species, one thirteen lines long, and a larger thirty-four lines long, which was a female. "The little one is distended with fluid in an extraordinary manner, so that the body has the shape of a ball, from which the head and limbs project. The fluid is contained in the abdominal cavity. The larger individual is distended in a similar way, but this is caused by an extraordinary development of the ovaria (or egg-producing structures). These organs become so large that, not having room in the cavity of the body, they extend right across the back, so that the animal is completely surrounded by a mass of the ovaries."

The Common Toad‡ is, of course, the type of the third family, the BUFONIDÆ. It has a swollen, heavy-looking body, covered with a warty skin, and it has a large flat head with a rounded blunt muzzle. There is a swelling above the eyes studded with pores, and the parotids are large, thick, prominent, and secrete an acrid fluid. There are no teeth. It has four fingers and five toes, and

* *Bombinator igneus*.

† *Pelobates fuscus*.

‡ *Bufo vulgaris*.

these last are very slightly webbed. The eye has a transverse pupil, and the colour of the body is a brownish-grey, dirty, or lurid. The tubercles are more or less brown, and beneath the creature is dirty yellowish-white, sometimes spotted with black.

The Toad sits up very much after the fashion of a Frog, but is quite as frequently seen with its



THE BROWN MUD-FROG.

Head nearer the ground. It does not take great leaps, for they are impossible to its short limbs and extremities, so it walks in a crawling sort of manner, often keeping its body supported on its limbs during a pretty brisk movement. It has no internal vocal pouch, and the tympanum is more or less distinct. It is a terrestrial creature, and hides up during the day in dark and damp situations, is very tenacious of life, and when it is stopped and handled, swells out its body, and some secretion comes from its glands, as well as water from the internal sac already noticed. By no means sly when kindly treated and fed, the Toad will become familiar in time. It is very curious to see them feed

when they are kept in hot-houses as destroyers of insects. Seeing a beetle or a grub, they remain stationary, the red iris of their eye looking very bright, and as soon as the prey comes near enough the mouth opens, and the tongue, which is free behind and attached within the lower jaw in front, is turned out and the prey is turned in, or quickly glued to the sticky surface. The mouth remains closed, and as the victim is swallowed whole, the eyes stare with satisfaction. A good-sized bee is taken, and sometimes a convulsive action denotes that either it has stung as it has gone down, or else that it is especially nice. A worm may be swallowed and partly return, but the Toad uses its forelimbs to crowd it into the mouth again.

In the spring time they betake themselves to the water, and the eggs are laid in strings of three or four feet in length, each egg being covered with a glutinous coat, so that the long line is about one-eighth or one-sixth of an inch in thickness. Usually the laying is later than that of the Frog, and the Tadpole is smaller and darker, and it is not until autumn that they come to land as little Toads. Every now and then the adult Toads cast their skin, and come out brighter in colour, and cleaner. They swallow this delicate cuticle, a process which does not take place in the Frogs, who lose it piece by piece. Toads have always been considered with aversion by the public, and their general character has been most blackened by those whose imagination transcends their experience. They are very useful animals, and they destroy a great number of injurious insects, and their good lives should be considered in relation to the stories about their misdeeds, all of which are false, and the outcome of prejudiced minds.

They endure for a long time without food, and they hibernate by getting into the mud, down cracks, and into holes.

The stories about Toads being found in stones, in mines, and in trees, in positions where they must have been kept from air and food for years or centuries, are not true. Dr. Buckland proved by direct experiment that no Toad can live for two years without food and air.

The alleged venom of the Common Toad, so long a subject of popular belief, has been rejected by many modern naturalists, among whom Cuvier may be particularly mentioned. The noxious matter is in follicles, chiefly in the true skin and about the head and shoulders, but they are also distributed generally over the body, and on the extremities. The Toads possess, besides, two glandular masses (parotids), which, when pressed, exude through small holes a yellowish thick humour of a musky odour. Pressure causes this fluid to exude or even spurt out to a considerable distance. Dr. Davy found it extremely acrid when applied to the tongue, resembling the extract of aconite in this respect, and it even acts upon the hands. A chicken inoculated with it was not affected. Dr. Davy conjectures that this "venom" is a defence to the Toad from carnivorous animals, and we have seen a dog, when urged to attack one, after some hesitation drop the animal from its mouth, in a manner that left no doubt that he had felt the effects of this excretion. In a Brazilian species the secretion acts fatally on chickens when introduced into their veins.

The Natter-Jack, or Rush Toad,* is not common. It is found in some places around London, or rather was twenty years ago, and White states, in "History of Selborne," that they were more frequently seen in his garden than the ordinary Toad. This Toad is of a light yellowish-brown colour, clouded with a dull olive, and there is a bright yellow line running down the back. It is a lively Toad, and it runs with the body considerably raised, and it is hardy, being often found in dry situations. Indeed, Bell notices their favourite resort at Selborne to be under a shallow layer of turf covering the top of a wall of a hen-pen, which is exposed to the summer sun, and is the hottest part of the garden. It is less timid than the Common Toad, and its eyes are more prominent, and are elevated above the head. The warts of the skin are larger than those of the Toad, but the glandular swellings are less on the head. Claus states that it has large glands on the legs, and that it runs badly; nevertheless, it often takes to the water at night, and especially to those lakes and ponds where there are reeds and rushes. They emit a smell not unlike the smoke of gunpowder. The male makes as much noise as a Frog, and cries *Glouk, glouk*. Eggs are laid in the water, and the Tadpoles are amongst the smallest, their metamorphosis not lasting much more than six or seven weeks. The Variable,† or Green Toad, found in France, has hind limbs and feet nearly as large as those of the Frog. It has an imperfect vocal sac, and calls *Mé, mé*. It swims admirably.

* *Bufo calamita*.

† *Bufo variabilis*.

The Indian Toads are not very remarkable, but it is interesting to notice that varieties of the Common European Toad are found in different parts of China and the islands of Chusan and of Japan. The species, Dr. Günther states, extends from Western Europe through the temperate parts of Central Asia to China and Japan. The Natter-Jack, or *Bufo calamita*, which is found in many parts of



(1) COMMON TOAD.

(2) BUFO VARIABILIS.

(3) NATTER-JACK TOAD.

Europe, occurs in Tibet, and the Common Indian Toad (*Bufo melanostictus*) has an immense range. It is one of the commonest Batrachians, and inhabits every part of the Continent of India from the Peninsula of Southern India to China and the Philippine Islands. In the Himalayas it extends to an altitude of 9,000 feet, and Cantor says it utters a chirping plaintive sound.

Amongst the African Toads, *Bufo carens* may be mentioned. It has a short head and a truncate nose, and a huge tympanum. The colours are red, green, and black. They are common in the interior districts of South Africa, in situations abounding in brushwood under decayed leaves. Two Toads.

prettily marked and blotched with light red, grey, and dark-brown tints, are also common in South Africa,* but nothing is known regarding their habits.

The Panther Toad† is an African form, and specimens are readily found in South Africa after a shower of rain. The Water-padda, a Cape of Good Hope Toad, is oftener found in water than on land.

The marshy and swampy districts of Central America near the sea have a large brown Toad covered with low unequal tubercles, and having huge parotids. It is called the Agua.

Mr. Darwin (when in South America) wrote :—"Amongst the Batrachian reptiles, I found only one little Toad, which was most singular from its colour. If we imagine, first, that it had been steeped in the blackest ink, and then, when dry, allowed to crawl over a board freshly painted with the brightest vermilion, so as to colour the soles of its feet, and parts of its stomach, a good idea of its appearance will be gained. If it is an unnamed species, surely it ought to be called *Diabolicus*, for it is a fit Toad to preach in the ear of Eve. Instead of being nocturnal in its habits, as other Toads are, and living in damp, obscure recesses, it crawls during the heat of the day about the dry sand-hillocks and arid plains, where not a single drop of water can be found. It must necessarily depend on the dew for its moisture; and this probably is absorbed by the skin, for it is known that these reptiles possess great powers of cutaneous absorption. At Maldonado I found one in a situation nearly as dry as at Bahia Blanca, and, thinking to give it a great treat, carried it to a pool of water. Not only was the little animal unable to swim, but I think without help would soon have been drowned."

Amongst the North American Toads there is the Carolina Toad, about two inches and a half long, which is found in the Southern States. It has a large head and mouth, and greatly elevated ridges above the eyes, ending in a knob. The lower jaw has a hook in front, and the parotid reaches from the tympanum to the shoulder. It has an internal vocal sac, and the dusky-brown yellowish body is warty. It is a timid, gentle animal, and ventures out in the dusk of the evening. It feeds on various insects, which it seizes only when alive and in position. Catesby says it feeds on fire-flies, and will by mistake capture a piece of burning charcoal. They become tame, and one, which had some water poured on its head, returned the next day for a similar kind treatment. Another is brick-red above, and lives in the oak forests of South Carolina (*Bufo erythronotus*). The Oak Frog (*Bufo quercus*), about three-quarters of an inch long, is a pretty little Toad with a flat head and pointed snout. It is of a light colour, and has a yellowish line along the back. The belly is silvery-grey, and the groins are yellow. It likes the sandy districts where small oaks replace the pine forests. The American Toad (*Bufo americanus*) is a very warty kind, and has a white line down the back, and it is about two inches and a half long. It is a timid animal, and lives like the English Toad. Its head is smaller in proportion to the European species, and there is a process on the root of the fore toe. It is widely distributed in the Northern United States.

The next family, the Engystomidae, is typified by *Engystoma carolinense*. It has a small, pointed short head, and the skin is a delicate chestnut above, and mottled with black beneath. It is a South United States form, hiding up by day and coming out in the evening after heavy rains. Others occur in the Peninsula of India.

The Breviceps are Toads which have not visible parotid glands or tympanic membranes, and they have an oval-shaped body, and the head and mouth are small, the feet being but slightly webbed. One called the Rain Paddock in the Cape Colony lives in holes or burrows in the ground, from which it emerges during rain, and on such occasions croaks loudly. It has a swollen-out body, and the head is scarcely distinguishable from it, and the surface of the skin is warty. Above, it is a dirty reddish-brown colour variegated with two or four rows of dull orange spots more or less distinct. Underneath, it is dirty greenish-yellow. The pupil is transverse and the iris green. When irritated it inflates the lungs to their utmost extent, and is then like a distended bladder, and discharges an acrid mucus profusely from its pores.

The Rhinophrynidae family are Toads which have neither tympanums or parotid glands, and the tongue is free in front, and the type is in Mexico.

The last family is that of the Rhinodermatidae, which have no parotids, but the transverse processes of the sacrum are large.

* *Bufo angusticeps* and *Bufo garicipensis*.

† *Bufo pantherinus*.

The second group of the Batrachians with tongues consists of the DISCODACTYLES, which have the tips of their large digits furnished with adhesive discs. They are usually called TREE FROGS, and the first family is the HYLORANÆ.

The Hyloranæ are interesting Frogs because, whilst the form of the head and body and the length of the limbs are very similar to those of the genus *Rana*, the more or less dilated extremities of the toes indicate a semi-arboreal life. These half True Frogs and half Tree Frogs are powerful leapers, and they inhabit Ceylon, the Philippines, and Archipelago, Western Polynesia, Madagascar, and West Africa. There is even a species from New Guinea.

The HYLIDÆ, the next family, have the extremity of their digits enlarged, rounded, and fashioned into a disc which is more or less sticky. They fix themselves to objects, and climb trees



THE ELEGANT HYLA.

with the aid of the discs. Living on trees during the summer, hunting insects amongst the leaves and boughs, some seek the water to lay their eggs and hibernate in the mud during the winter, and others lay in collections of water in the trunks of trees, and in the branches. The male has a vocal pouch which he swells out when he croaks.

The Common *Hyla** of Europe is green, with a yellow and black line along the body, and is paler in tint beneath. It lays when it has attained the age of four years. The head has a soft skin, and it has, in common with the family, maxillary teeth, but no parotids. It has a large vocal sac (the male), and when in shrubs and green trees it can hardly be distinguished by its similarity of tinting. It has an immense distribution in Europe, and Günther states that in Southern China and in Formosa there is a *Hyla* which closely resembles the European form.

The genus is, with this exception, absent in India and Tropical Africa.

Central America has a lovely Tree Frog which is sky-blue on the back and rose-coloured beneath, and the North American Goose-footed *Hyla*, a large kind, is cross-barred irregularly with red and fawn tints.

The South American Tree Frogs are numerous, and some have fine noisy voices. One from Guiana and Brazil has a red-brown upper surface, yellow-white sides, and there is a curiously-shaped

* *Hyla arborea*.

line of silvery tint beginning at the eyes, and surrounding the top of the body. It is the Elegant Hyla.* Another, with a broad head, large discs, and slight webs, is a large Frog measuring three inches and a half in length, and it inhabits the same localities as the last species.†

The Common Golden Tree Frog‡ is widely distributed over Australia, and is the most common of all the Batrachians there. The natives, when pinched for food, capture large numbers by the light of a torch at night, and a supply of this Frog can always be secured in the neighbourhood of fresh water.



THE GOOSE-FOOTED HYLÆ.

In Tasmania there is a little Hyla (*H. Ewingii*), which has no web on the extremities.

Hyla versicolor has a moister and more viscid look than the other species, and more resembles a Toad in form. It is a great croaker in damp weather, and it lives on trees in the Northern United States. It is a beautiful creature, and the colour varies from the palest ash to dark brown, and it is blotched with brown, green, white, and yellow.

There is a genus of this family of Hylidæ which lives in Mexico, and is remarkable on account of the existence of a pouch on the back of the female, just above the lower part of the spine. This *Nototrema* § is a curious form even in the Tadpole state, for its branchiæ are terminated by a disc which is bell-shaped. The eggs are placed by the hind feet of the male into the pouch of the adult

* *Hyla elegans*.

† *Hyla palmata*.

‡ *Hyla aurea*.

§ *Nototrema marsupiatum*.

female, and they undergo their transformation and live as Tadpoles there, hopping forth in due time as perfect Frogs.

The Tree Frogs belonging to the genus *Polypedates* are arboreal in their habits, and have the fingers and toes ending in discs. They are found very widely distributed in the East Indies and in Madagascar, and they are very interesting from being able to change their colour. They have a smooth skin and a short fold from behind the eye above the tympanum, which is more or less distinct. The adults have vomerine teeth, and the tongue is long and deeply notched behind. The fingers are slightly webbed, and the toes are broadly so. The discs are well developed. The Common Indian Tree Frog* is one of them, and is found widely over Ceylon and the Indian Continent. It



THE POUCHED FROG.

ascends to an altitude of 2,780 feet in the Sikkim Himalayas, and at Penang, where it is not found in the valleys, it lives at a height of 2,000 feet. They are slender Frogs with broad heads and short snouts. They change their colours, for sometimes they are buff above, sometimes ashy-grey, or chocolate-brown tinged with rose or lilac, black spots being more or less visible.

The Spurred Tree Frog † has a flat, depressed triangular head, a large eye, the tympanum being half its size. Its fingers are not webbed, and the heel has a spur-like appendage. The male has vocal sacs. The colour is greyish or olive-yellow above, with an hour-glass black mark on the back. It is yellowish beneath, and the hind limbs have dark cross-bands. It is not rare in Ceylon. Another kind is from Afghanistan, and it is a brown Frog very finely speckled with grey.

The genus has a species in Natal, and Dr. Andrew Smith found it on the leaf of a thick reed growing on the marshy banks of a small river a little to the westward of Port Natal. Others are found in Madagascar and Japan.

There are some small Tree Frogs which inhabit Ceylon, Java, the Philippine Islands, and Borneo. They have no vomerine teeth, and the skin is smooth or else tuberculate, and their tongue is long and

* *Polypedates maculatus*.

† *Polypedates eques*.

deeply notched behind. They have well-developed limbs, the fingers quite free, and the toes are webbed, the discs of the toes and fingers being well developed. The Variable *Ixalus** of Ceylon is one of them, and is about one inch and a half long, the hind limb being two inches and one-third long, and is very variable in its coloration. Probably one of this genus lays its spawn in a remarkable manner. Thus, Mr. Holdsworth found in Ceylon, hanging from the side of a stone cistern, a lump of spongy soft substance as large as a crow's egg. It was found about eight inches from the usual surface of the water in the cistern. Dr. Günther examined the mass, and found it indistinctly greenish and cellular, and that it consisted of an interlaced tissue, enclosing large and small spaces, which may have been filled with air or water. A few lines below the surface of it ova were found; some in the meshes of the tissue, and others accumulated towards the centre in a lump. They were as large as a pin's head. It is remarkable that this peculiar mass of fibres of uncertain derivation should be so excellent a protection to the ova, and, indeed, a better one than the usual glutinous stuff which is secreted around the Common Frog's spawn. Whether the cells below the surface of the mass contain air to keep it floating, or whether they once contained water to support the young, is uncertain. It is known that some Tree Frogs deposit their spawn in the water which collects in the hollows of trees and branches.

Dr. Günther, during an examination of a number of small Tree Frogs from Ceylon, noticed one which had the ova attached to the under part of the body, or, rather, they were attached when the creature was caught, but came off, adhering together like a flat disc in shape, but they left their marks on the mother. They were of the size of a hemp-seed, and the Frog was scarcely two inches in length. This method of carrying the ova beneath the body is exceptional in Frogs.

The North American genus *Acris* has species in which the foot webs and discs are small, and it really closely resembles a small Land Frog.† It is fond of the water, and may be seen on leaves in ponds, and the male, which has an internal vocal sac, is noisy. It has a large heart-shaped tongue. Holbrook, the American herpetologist, described it as a merry little Frog, which chirps like a Cricket, and may be domesticated.

In Nepal and Sikkim, at an altitude of 5,200 feet, there is a slender, smooth-skinned Tree Frog, with a body three inches and two-thirds in length, the hind limb being six inches in length. It is one of the largest of the Tree Frogs, and is green during life, and uniform dark violet above, after death, and brownish below. The fingers and toes are entirely webbed, and the terminal discs are very large. The vomerine teeth are in two series. It belongs to the genus *Rhacophorus*. All the species of this remarkable genus have the digits very flat, the discs greatly dilated, and the web large. They inhabit Java, Malabar, Madagascar, and a sub-genus is on the mainland of West Africa.

The *Hylodines* are a sub-family of the *Hylinae*, and have no web on the toes. Some belonging to the genus *Hylodes* have teeth on the vomer.

The little *Hylodus ocularis*, one of this group with free digits and vomerine teeth, is only eleven lines in length, legs and all, and is very pretty, resembling the *Acris gryllus* in its habits. It is found on myrtle leaves, and is diurnal in its habits, seeking its food by day. Like the others of its genus it delights in the sunshine, but they retire to dark, damp places, and sit in the water half covered. South Carolina and Georgia are their localities.

In one of the group called the Martinique Frog,‡ which is distributed in some of the other islands of the Antilles, the eggs are laid, but do not bring forth Tadpoles. On the contrary, the metamorphosis proceeds inside the egg in about seven days, and the Tadpole state is thus rapidly passed through there. When the little *Hylodes* bursts forth, it is a tiny perfect Frog with a little tail, but this is soon absorbed.

A family of the Tree Frogs, the *Phyllomedusidae*, with maxillary teeth and parotid glands, has a very peculiar opposable condition of the digits, so that the hands and feet grasp the twigs and branches like those of Apes. One of these is from Cayenne and the Brazils, and is blue above, and the sides and legs are spotted with white. It is called *Phyllomedusa bicolor*.

The Great Green Tree Frog§ is the largest of the *Batrachians* which is found in every part of Australia, and in New Guinea. Specimens are seen as large as a man's fist. This species feeds upon almost every living object that can be swallowed—Lizards, Frogs, all kinds of insects, and

* *Ixalus variabilis*.

† *Acris gryllus*.

‡ *Hylodes martinicensis*.

§ *Pelodytes caeruleus*.



RHACOPHORUS RHEINHARDTI.

young birds, and the nestling of a small Honey-eater has been taken out of the stomach of one of these insatiable creatures.

A species of *Pelodryas*, also a member of this family, is from New Zealand, and has very large discs to the fingers, and the first finger is opposable to the other three, and is joined to the second by

a rudimentary membrane, and the others are partly webbed, the third and fourth having conspicuous tubercles. The toes are nearly full-webbed, and the discs are smaller than those of the fingers. This very pretty polychromatic Frog is not unlike a *Rhacophorus*, but the incomplete webs on the hands are distinctive.

The last family to be noticed, the *Dendrobatidæ*, has genera whose species have no maxillary teeth and no parotids. The figure is very Toad-like, and there are not webs uniting either digits or toes, but they have all these dilated at the tips. There is no expansion of the processes of the sacral vertebrae. The species of the genus *Dendrobates* live on trees and bushes, and the best known is from Cayenne and Brazil. It* is said to have a very remarkable power of tinting, and its blood, when applied to the wounds of green Parrakeets from which the feathers have been torn, is said to produce a red or yellow colour in the new plumage! The males have a throat sac. In all the tongue is ribbon-shaped, and much of it is free. They are usually black, with a white splash on the head, which is extended in a radiating manner over the eye; another is across the loins, and there are white branchings on the shoulder.



PHYLLOMEDUSA BICOLOR.

A little Frog two inches in length inhabits the country to the east and north-east of the Cape Colony, and Dr. Andrew Smith states that specimens are usually found in or about cavities which exist in the trunks of trees. When got out of the holes they appeared inanimate, but the influence of a warm sun soon imparted a moderate degree of vigour to them, and in a few hours after their liberation they were tolerably active and able to move from place to place. In one instance five specimens were found by a workman (unfortunately not by Dr. A. Smith) in the middle of a tree nineteen inches in diameter, and no hole led to the outside. It is called *Brachymerus bifasciatus*, and its dark body has a pretty yellow line on either flank, with spots on the limbs. The jaws and palate are without teeth. There are no parotids, and four of the digits and the five toes are free, but the tips are dilated. It probably belongs to this family.

The genus *Plectropus* probably belongs to this family, but the sacral transverse process is enlarged, and there are no discs to the fingers or toes. Moreover, four fingers are free from web, and the five toes are palmate. The Painted *Plectropus*,† of a brown ground tint, relieved with a marbling of black spots, is from Manilla.

* *Dendrobates tinctoria*.

† *Plectropus pictus*=*Callula picta*.

CLASS AMPHIBIA.

CHAPTER II.

TAILED AND VERMIFORM AMPHIBIANS.

THE TAILED AMPHIBIA—Characteristics of those with Persistent Branchiæ and of those that lose the Branchiæ Early in Life—Skeletal Peculiarities—**THE SALAMANDERS**—Distinctive Features—The Spotted *Ellipsoglossus*—Why so called—The Tritons—The Great Water Newt—Its Ferocity—Habits—Appearance—Rusconi's Observation of the Egg-laying Process of the Triton—Growth of the Embryo—The Mature Tadpole—The Power of Repair—The Straight-tipped Water Newt—The Common Smooth Newt or Eft—The Palmated Smooth Newt—Distribution—**THE SALAMANDERS**—The Spotted Salamander—Description—Where Found—Hibernation—The Black Salamander—Mlle. Marie de Chauvin's Observations of the Changes of the Tadpole Salamander—The Genus *Pleurodeles*—The Genus *Pseudotriton*—Is the Bite of the Salamander Poisonous?—The Absurd Notion of their being Incombustible—The Genus *Salamandrina*—**THE PLETHODONTIDÆ**—The Genus *Desmognathus*—**THE AMBLYSTOMIDÆ**—The Axolotl—Their Life History—The Amblystoma, or Adult Form—**THE ICTHYOIDEA**—Characters—**THE PERENNIBRANCHIATA**—The Sirens—Appearance—Habits—**THE PROTEIDÆ**—The Proteus—The Genus *Menobranhus*—**THE DEROTREMATA**—The *Amphiuma Means*—The *Amphiuma Tridactyla*—The Hellbender—The *Sieboldia Japonica*—**THE APODA**—Characters—Classification of the Amphibia—**THE EXTINCT AMPHIBIA**.

ORDER URODELA.—THE TAILED AMPHIBIA.

THE bodies of these Amphibia are long and rounded, tailed and webbed, and usually the fore limbs are remote from the hinder. Their small limbs, the posterior being sometimes deficient, are useful in enabling them to move on land, and, in some, in water. Their aquatic life might almost be predicted from their shape, and especially in the case of those which have the branchiæ on the side of the neck persistent. Some live more on land, and have no branchiæ during adult age, and are aquatic. It appears that the branchiated kinds, and those with clefts, have biconcave vertebræ, and that the others, which lose their branchiæ early in life, have an articular head in front of the vertebræ and a cavity behind. The first ally the others to the fish, and even a part of the notochord is visible in them. The Urodela have rudimentary ribs, and in the tail there is an arch of bones to protect its vessels. The skull, usually flat, is never completely ossified, and in the branchiated kinds the cartilaginous and membranous parts of the young skull persist. The eyes are sometimes rudimentary, and are placed beneath a transparent skin, and there is no tympanum. The teeth are usually small and curved; they are in a single row on the lower jaw, and they exist both on the upper jaw and on the palate. The tongue is fixed below, and is free at its edge. The heart in some has the auricular septum more incomplete than in the Batrachia, and in the Proteus there are three branchial arches, and the bulb of the aorta splits into two trunks; and by subdivision three pairs of aortic trunks are formed, and the bases of the branchial artery and vein anastomose in the first two gills, but not in the third. In others, and in the Salamanders, there are four pairs of aortic trunks.

The skin glands are found along the sides of some of the aquatic Amphibia, and also beneath the jaws and on the top of the head.

The Urodela are divided into sub-orders, the Salamanders and the Ichthyoidea, and these into the Perennibranchiate and Derotreme groups.

THE SUB-ORDER SALAMANDRINÆ.—THE SALAMANDERS.

These Lizard-shaped Amphibia are tailed, and breathe by internal lungs. They have eyelids which are horizontal, and the vertebræ are convex in front and concave behind. They have no branchiæ, or gill clefts, in their perfect or adult age, but some have them during their youth. More or less Lizard-like in shape, the fore limbs are furnished with four and the hind limbs with five digits. Their skin is glandular, viscid, and often secretes a milky liquid which is acrid. In some the glands aggregate near the ear, as in the Toads, and some have the gift of changing colour, through possessing movable colour cells. The males and females differ, and the first have a fin-like crest usually on the back and tail.

They are usually divided into four families, and the first is typified by a Japanese kind which appears to link the land-living and the aquatic Salamanders together.

It is long-bodied, and has a short tail, which is more and more compressed towards the tip. The head is small, and the neck also, and it is rounded. Its eyes project, and the nostrils are well in front. The skin is smooth, and as it were polished, and has folds and mucous pores, and is of an ashy-grey or blue-grey colour marked with white on the flanks. It is a small animal with four digits, and is called, from having an oval-shaped tongue, *Ellipsoglossa naevia* (the Spotted Ellipsoglossus). Another kind is, on the contrary, fitted by its compressed body and tail for living in water, and is the Clouded Ellipsoglossa, and is also from Japan.

The next family, the Salamandridæ, contains the Newts and Efts, and the Salamanders, and although the well-known shape and the outside characters would enable its genera to be associated more or less, it is advisable to state that the members of this family have the palatine teeth implanted on the inner margin of the diverging and posterior prolongations of the palatine bones, and that they are in two rows placed longitudinally and diverging posteriorly.

The Tritons (genus Triton) are numerous in species and individuals, and besides the structural peculiarities of their family, they have the body covered with warty tubercles; the four short limbs have toes, four on the front, and five on the hinder, and are without nails. The male has well-marked crests on the back and tail, which are not continuous, and there are no parotids, but there are glandular pores above and behind the eyes, and also a longitudinal series of similar pores on each side of the body. They are very Lizard-like in shape, and the tongue is globular, free at the sides slightly, and free behind, where it is pointed.

The Great Water Newt * grows to the length of six inches, and is the largest of the British kinds. Not at all uncommon in ponds and ditches, it preys upon the water insects, and during the spring feasts on the Tadpoles of the Common Frog. They even devour the other and smaller species of Triton, which they seize, according to Bell, with ferocity, and hold fast in spite of the efforts made by the victim to escape. They will bolt specimens of the Small Eft, which wriggle and give much trouble in the act of swallowing. It is a very aquatic species, and rarely leaves the water, and during the winter it remains torpid at the bottom of ponds and ditches until the warmth of spring returns. It has a flat head, and the upper lip overhangs the lower, and the trunk is nearly continuous with the head, the intervening neck being marked with a fold of skin. The body is thick and round, and the upper parts are blackish-brown with darker round spots, and the under are bright reddish-orange, with round black spots. The sides are dotted with white, and the sides of the tail in the male are a beautiful pearly white. The male has a back crest during the breeding season which disappears in the winter. They swim principally with the tail, the legs being turned backwards; but when they float on the surface of the water they sprawl their limbs out and their toes also. At the bottom of ponds and on land they crawl with the aid of their weak extremities. They change their skin, and it comes away in shreds. The female is like the male in the winter, but she has no trace of a tail crest. The Prince of Musignano states that the Newt dies in convulsions if salt be sprinkled on it. The egg-laying is a curious process.

Rusconi noticed, whilst watching the egg-laying of the Triton, that the females from time to time pressed back their hind limbs, and that in a few moments after this action they laid one or two eggs, which remained attached to them, so that some of the animals might be seen moving to and fro in the tub, with two or three eggs thus attached.

He made a small bunch of the plant *Polygonum persicaria*, and put the stems of them under a large stone to confine them at the bottom. In the evening he inspected the tub, and found all his Tritons so comfortably accommodated by the help of the plants, that by keeping the head a little elevated their nostrils were kept above the surface of the water, so that their respiration was easy.

Whilst under the influence of surprise at this, he observed one of them approach one of the leaves of the plant, as if to smell it. The animal then moved gently on the leaf in the direction of its breadth, and, resting upon it, pushed back its hind limbs so as to fold back and enclose the leaf between its feet. It stayed about a minute in this position, and then went away, leaving the leaf so that its apex was turned back on the petiole. After a lapse of three minutes, Rusconi saw the Triton approach another leaf, apparently disposed to place itself thereon, when, casting his eyes accidentally on the other branches, he discovered many other leaves doubled back. He immediately took the bunch

* *Triton cristatus*.



from the tub, and on examining the leaves which the Newt had doubled and stuck with a sticky secretion, he found that each of them enclosed an egg.

On looking at one of these eggs, it will be observed that the future Newt, or embryo, is in the centre. It is white, with a yellow tint, and is environed with a glairy matter, to which it is so attached that it can move freely in every direction. Its envelope is membranous, of glassy transparency, and is covered with a very clear viscid matter.

The growth of the embryo is rapid under the influence of warm weather, and in five days, according to Rusconi, it is bent in shape, and little knobs are near the larger end, and on the seventh they are evidently the rudiments of gills and legs. By the ninth day, the tail is oar-like in shape, the heart may be seen to beat, and on the next day there are on either side of the head the rudiments of an anterior limb, also claspers besides the gills. In two or three days the eyes are seen, and the gills have become leaflets, and the little one escapes into the water at about the fourteenth day. It moves in a very mechanical way, and hangs on to the first object with its clasping hooks. In about twelve days the fore feet have become lengthened, and there are rudiments of toes, and red blood circulates in the branchiæ, or gill-like leaflets, and the claspers have disappeared; moreover, there is much volition, and the little thing hides up and rushes after its prey. The hind feet appear on the thirty-fifth day, and attain a good development by the forty-seventh, and the longest gills have as many as twenty leaflets full of vessels. The Tadpole matures on the eighty-third day, and then the gills become smaller, and are soon obliterated, so that in five days, or shortly after, they and the clefts in the neck for the outward passage of water taken in at the mouth begin to be absorbed and covered with skin. It soon respire atmospheric air only, and having thus arrived at its perfect state, it makes efforts to escape from the vessel in which it has been isolated. This species lives in and on the water, and is seldom to be found on land.

They have, in common with most other Salamandroids, the power of repairing great injuries to the body. Loss of the limbs, tail, and even head, has been followed by a process of repair.

Mr. Bell has described a straight-lipped Water Newt* which is a rare British species. It has a rough and tubercular skin, more so than in the Great Newt, and its upper lip does not overhang, but is straight. He also places the Common Smooth Newt, or Eft,† in a genus called *Lissotriton*, but it may as well remain in the genus *Triton*, for the only essential differences are that the skin is smooth, there are no pores on the sides, and the crest of the back is continuous with that of the tail. It is very common and likes clean water, and it feeds on worms, minute mollusca, and water insects and gnats, but it is devoured by larger Newts and fish. They lay on the folded leaf like the Great Newt, but quite as often in the axils of the leaves, and after the tadpole state many quit the water and remain on land. Many of the adults may be found creeping about among the herbage in damp places, or even venturing into damp cellars. The crests are seen in the spring, and are lost in the autumn, when the colours of both sexes become dull. The tips of the crest are red, and the belly is bright orange in the early part of the year. They lose their skin in a whole piece sometimes, but usually in strips. Their length is about three inches seven lines in large specimens, the tail being one inch and three lines of the whole.

The Palmated Smooth Newt[‡] has the hind feet webbed in the male, and the tail is truncate with a slender end. The beak is flattened, with a raised line on each side. It has been found near Bridge-water, the Isle of Wight, Reading, near Edinburgh, and as far north as Sutherland. It was supposed to be a kind which is found in Switzerland, France, Central Germany, and Belgium, but the English species is smaller, its head is flatter and broader, and the low lateral ridges are characteristic. The webbed state of the hind feet, although it diminishes in winter, and the straightness of the back crest, are very peculiar. The filament which ends the tail is from two to four lines in length.

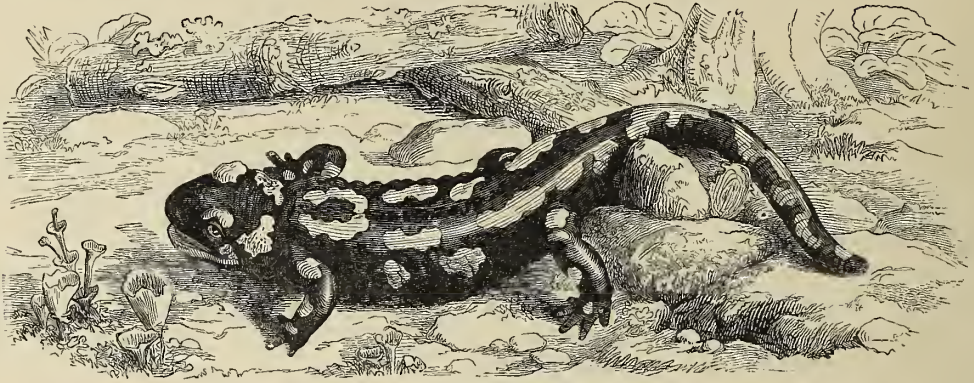
THE SALAMANDERS.

The Spotted Salamander§ is the type of this genus,|| and it has a thick, large head and clumsy body, and a tail which is cylindrical at its outer end. The eyes are large, and the body is of a black colour, with yellow spots, and there are numerous prominent warty growths on the sides. It has a large

* *Triton Bilronii*. † *Triton punctatus*. *Triton vittatus* (Grey) is a variety. ‡ *Triton palmipes*.
§ *Salamandra maculosa*. || *Salamandra*.

tongue. The teeth on the palate are in long series, and the mouth-gape is ample. The parotids are very developed. The toes are free and smooth.

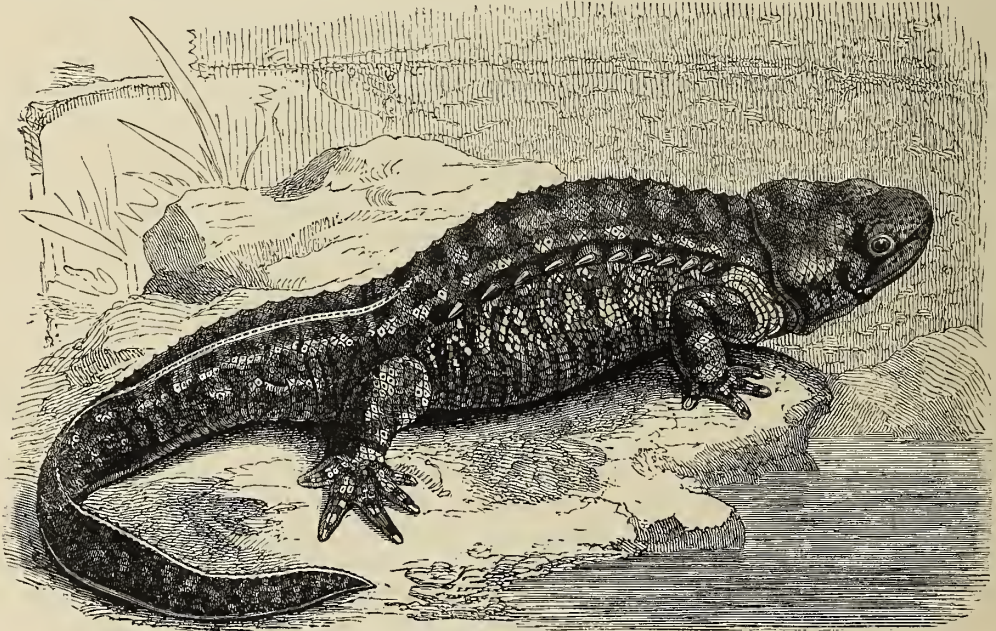
This is a dweller on land in the adult state, and is found in Central Europe, in the mountainous



THE SPOTTED SALAMANDER.

districts of Southern Europe and North Africa. They haunt cool and damp places, such as fallen timber and old walls, and they feed on insects, worms, and slugs. They hibernate in the winter, coiled up in the crack of a wall, the hollow of a tree, or in the ground; and during the spring and summer, they shed their coat in shreds.

The Black Salamander* is found in the high mountains of Central Germany, France, and Switzer-



PLEURODELES WALTII.

land, and it has of late years been studied in regard to its extraordinary viviparity. The young undergo their metamorphoses in the body of the mother; but only the lower eggs in the body are hatched within, and the resulting Tadpoles appear to destroy the others. Mdle. Marie de Chauvin, by taking the young from the body before they were fully developed, and placing them in water, tried to watch the changes of the Tadpole Salamander, but only in one instance did she succeed. In four days

* *Salamandra atra*.

the little Tadpole got rid of its gills, which were replaced by others of an unusual form, and the new ones adapted the creature to its novel existence. It lived for fifteen weeks at the bottom of the water, and grew considerably. Then the gills atrophied, and the tail and skin altered, and finally, after moulting its cuticle, the Salamander quitted the water, and then the gill-clefts closed, and it became an adult Land Salamander. This observation is interesting in connection with the history of the Axolotl, which has branchiæ in early life, and may lose them later on.

The next genus, *Pleurodeles*, has short ribs, which give the appearance as if they penetrated the flanks, but their ends come against the tissue under the skin, and produce horny projections thereon. The tail is long and compressed, and the small tongue is adherent only in front, and there are two series of palatine teeth in longitudinal series. The Spanish kind has an ashy-grey body,* very prettily marked with long transverse stripes and dots. It is very like a heavy Lizard.

The genus *Pseudotriton* includes a red kind with numerous small black points, and the abdomen is orange-red. It is a land animal, and is found under rocks and fallen and decaying trees. It will take to the water, and this pretty little thing lives on insects, and is a North American kind.

There have been many stories about the Salamanders producing poisonous results, and an able writer in the "Penny Cyclopædia" may be thus quoted regarding them :—

"The body of the Salamander is largely covered with warty glands. These secrete a milky fluid of a glutinous and acrid nature, which, if not capable of affecting the larger and more highly organised animals, appears to be a destructive agent to some of those which are less highly organised. Thus Laurenti provoked two grey Lizards to bite a Salamander, which at first attempted to escape from them, but being still persecuted, ejected some of this fluid into their mouths; one of the Lizards died instantly, and the other fell into convulsions for two minutes, and then expired. Some of this juice was introduced into the mouth of another Lizard: it became convulsed, was paralytic on the whole of one side, and soon died. According to Dr. Barton, this fluid—which the animal secretes in large quantities when irritated, and is then capable of ejecting it to some distance—is not soluble in water, though it dissolves readily in spirit of wine. He found the taste of the juice of *Salamandra subriolacea* extremely acrid, resembling corrosive sublimate, and very astringent.

"Such is the extent of the foundation for the long-cherished assertion that the Salamander was one of the most venomous of animals. Nicander, in his 'Alexipharmaca,' gives an appalling picture of the symptoms produced by its bite. The Romans looked on it with horror as most destructive, and considered it as deadly a part of the poisoner's laboratory as aconite or hemlock. Hence came the proverb that he who was bitten by a Salamander had need of as many physicians as the animal had spots; and another still more hopeless :—'If a Salamander bites you, put on your shroud.'

"But the grand absurdity of all was the belief that the Salamander was incombustible; that it not only resisted the action of fire, but extinguished it, and when it saw the flame, charged it as an enemy which it well knew how to vanquish."

The last genus of this group is *Salamandrina*, and a species is found in Italy and Dalmatia. They are small Salamander-like creatures, and their head has a triangular reddish spot, and the rest of the upper part is black. Beneath the body the colour is white, spotted with black, and the under parts of the thighs are reddish. The tail, cylindrical in shape, has sharp ridges above and below, and the hind feet have four free digits. The tongue is fixed in front, and the palatal teeth, parallel in front, are divergent behind. They are barely two inches in length.†

The next family are the *PLETHODONTIDÆ*, and a species (*Plethodon glutinosa*) has a cylindrical body, with a lax skin, which is folded on the back. The tail is very long, the head large and flat, and the palatine teeth are in two long converging lines. The colour is dark or blue-black, and there are little white spots on the sides of the skin and stomach. It is found from Massachusetts to Florida.

The genus *Desmognathus* is one of the family, and its species have the posterior half of the tongue free, and it can be ejected beyond the mouth. Mr. Leiss, writing in the *Scientific American*, may be thus quoted about the brown species, which lives in the North-Eastern part of the United States :—

"They inhabit the shallow and stony spring brooks of hillsides and springs. I never have found them far away from spring water. They are rarely seen swimming, but must be looked for beneath the

* *Pleurodeles Wallii*.

† *Salamandrina perspicillata*.

stones. When a stone, beneath which one is hiding, is first lifted up, the *Desmognath* is generally surprised and dazed, and remains quiet for a few seconds. It must then be quickly seized, or it darts off into the water and escapes.

"The metamorphoses of this species do not differ materially, so far as I have observed, from our other *Batrachia Urodela*. The young are furnished with gill-tufts, and are entirely aquatic in habits. When young they are lighter in colour than the adult, and often assume the colour of the mud or sand of the stream they inhabit, and are thus not easily detected. The Brown *Desmognath* feeds upon earthworms and insects. I found in the stomach of an individual three inches and a half in length an earthworm over two inches long.

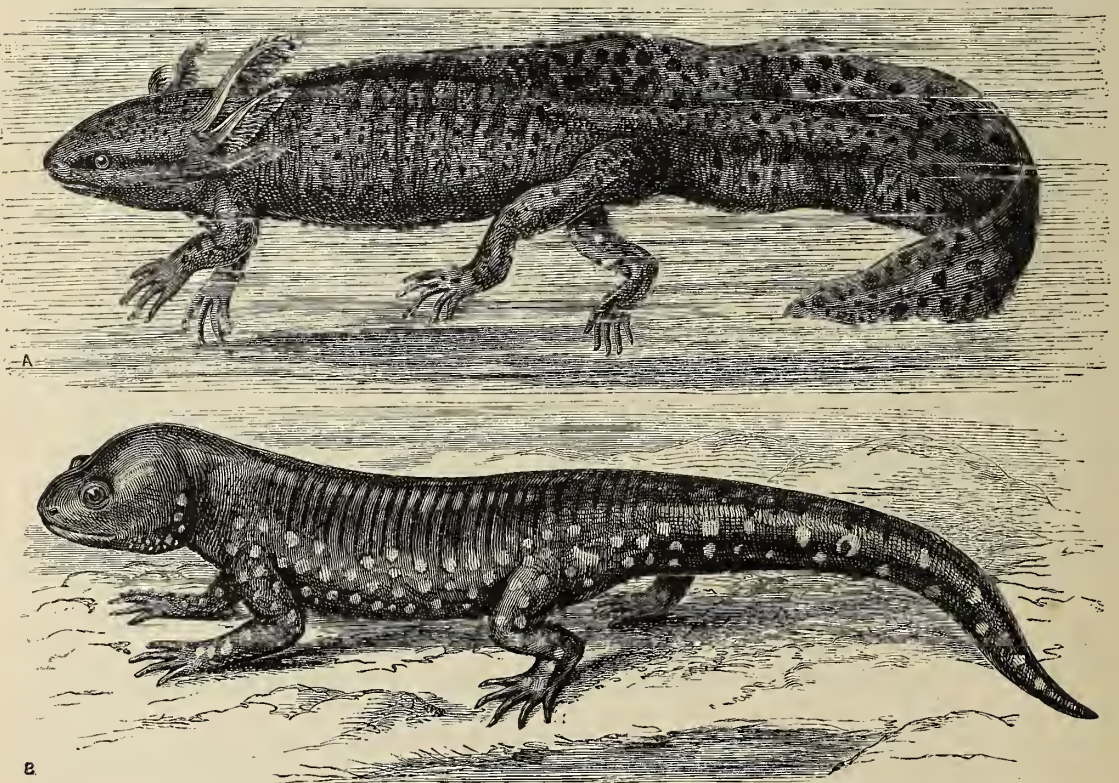
"The generic name, *Desmognathus*, means band, or ligature jaw, so called on account of the tendinous ligament (one on each side) passing from the atlas over the parietal and pro-otic bones to the jaw. This, like a *ligamentum nuchæ*, supports, or rather, in this case, gives great power to the head, which is necessary in pushing up stones when in search of the worms upon which it feeds.

"The stagnant water of the aquarium seems ill fitted for the life of this lover of spring brooks, for we could never succeed in keeping them alive for more than a few weeks."

The history of the early life of these non-branchiate *Amphibia* with tails is interesting, and it is very probable that some of the *perennibranchiate Amphibia* are really the larvæ, or immature forms, of others of this sub-order. This is evidently the case in the next family.

THE FAMILY AMBLYSTOMIDÆ.

One of the most interesting of the Mexican *Amphibians* is the so-called *Axolotl*, or *Siredon*, which lives in the lake which surrounds the city of Mexico. They are like stout, short-legged *Lizards* in shape, and are from eight to ten inches in length, and have short extremities, there being four digits to the fore limbs and five to the hinder. The colour is dark grey, or almost black, with dark spots, and there are three well-developed *branchiæ* on each side of the neck. There are teeth in



THE AXOLOTL IN THE EARLIER (A) AND IN THE LATER (B) STAGES OF ITS EXISTENCE. (After Dumeril.)

the jaws, and two lines of them on the vomer. Cuvier had doubts about placing the Axolotl amongst the Amphibia with persistent branchiæ, but he stated that so many witnesses gave evidence in favour of the branchiæ not being lost during growth that he was obliged to do so. Time and research have produced a curious history about these creatures, and have demonstrated their relation to a perfect and non-branchiate form.

The Axolotles, furnished with gills, reproduce by laying eggs, and at first this was considered sufficient to determine that they were perfect animals, and that no further growth or change was possible. They were placed by zoologists in a genus of the perennibranchiate Amphibia. But in 1865 M. A. Duméril saw the Axolotles lose their branchiæ, and become altered in shape. They resembled in this the Tritons and Salamanders, or non-branchiate group, and they became Amblystomes, a kind of Amphibian which had been known before. Some Axolotl eggs turned to creatures like the parent, but after a while they lost their gills and became Amblystomes.

The Axolotles can thus become "by metamorphosis" Amblystomes,* or adult forms.

Subsequently Axolotles were watched, and the eggs they laid were placed, first, on dry ground, secondly, in water, out of which the young could readily emerge. Out of those under the first condition four turned as usual to Axolotles, and two were born as perfect gill-less Amblystomes; and under the second four turned to Axolotles and one to an Amblystoma. Then an Amblystoma laid eggs, and they were placed under the circumstances mentioned above, and many more Axolotles were produced than Amblystomes.

One of the Amblystomes thus obtained laid eggs on a certain 17th of April, and tadpoles were soon produced, and they grew to four inches in length in three months. They presented all the characters of Axolotles, but the colour of the markings of the skin differed. It is evident that the immature Amblystoma (the Axolotl) lays eggs, and that the perfect form (Amblystoma) is not sterile, but can produce eggs, some of which develop into the usual larval or Axolotl forms, and others into Amblystomes, and the surrounding conditions appear to have to do with the direction of this evolution. The Amblystomes are numerous, and have the skin much folded on the body; the tail is thick and almost cylindrical at the base. They have palatine teeth, forming two transverse rows, which are re-curved, and the tongue is large and fixed inferiorly.

The Mole Amblystoma† is a little short-tailed dweller in the light soils of the islands on the coast of South Carolina, and its underground retreats can be discovered by the slight upheaval of the earth which accompanies them.

The Tailed Amphibia are very sparingly distributed in India, and Dr. Günther mentions one genus, *Cynops*, which has species in China and Japan, and another, *Plethodon*, which is North American, and has one species in Siam. *Plethodon persimilis*, from Siam, is so similar to *Plethodon glutinosus*, from North America, that Dr. Gray stated that at a first glance they might be considered to be identical.

Mr. Wood Mason has noticed a Newt from the Darjeeling Hills, and it is the first from British India. It has horny matter accumulated at the points where the ends of the ribs project against the skin, as in the genus *Pleurodeles*.

SUB-ORDER ICHTHYOIDEA.

These are the lowest, so far as organisation is concerned, amongst the Tailed Amphibia, and present, as it were, the early life of the first sub-order, the Salamandridæ. The larval state of these last is persistent in the adult Ichthyoidea, which, more or less fish-like in construction, have in the vertebral column remnants of the notochord, and the vertebral centra are concave in front and behind. Even the teeth on the palate resemble those of fish. In one group of the sub-order the branchiæ are persistent, and there are always gill-clefts, and these are called the perennibranchiata, and in another the external branchiæ are not found in adult age, but there are gill-clefts. These are the Derotremata.

The first group, the PERENNIBRANCHIATA, have long bodies, short limbs, the hinder pair being deficient in some, and the branchiæ are persistent in all, and so, of course, are the gill-clefts. Usually, there are no superior maxillary bones, and the palate is armed with rows of teeth. There are three families, and the first is that of the Sirens (*Sirenidae*), of which the Siren is the type.

* *Amblystoma Mexicanas*.

† *Amblystoma talpoidea*.

The stagnant waters and marshy ground of South Carolina, especially where rice is cultivated, are frequented by a very eel-shaped creature of an olive or blackish colour.* It has the anterior limbs, which are small, ill-developed, and bearing four digits each; but there are no hind limbs. The tail is flat from side to side, and there are on each side of the neck three very visible gills, increasing in size from the first to the third, and bearing branchial branches. Its eyes are small and covered with skin. The gape of the mouth is not great, and there is no visible ear. Its lower jaw has a horny sheath and several rows of small teeth, and the upper jaw is toothless, but there are teeth on the palate. It lives in the mud, and travels into the water or on to the land occasionally, and it preys on earthworms and insects. In captivity it hides in the mud and devours meal-worms. This lowly-organised Amphibian retains its branchiæ and gill-clefts, three in number, through life, and the blood corpuscles are elliptical in outline, nucleated and vast in size, being $\frac{4}{5}$ of an inch in length. The lungs are bag-like and long. The Siren has amphicealous vertebræ and small ill-developed ribs, and the wrist and the ankle are cartilaginous.

The usual length of the head is one inch, and of the body and tail eighteen inches, but they frequently attain the length of three feet. This Siren is covered with a thick mucous, and has a disagreeable smell. When it wishes to inspire it rises to the surface, about three times in twelve hours, and it gets rid of some air under water about once in two hours. It is, however, only an occasional inhabitant of water, and it prefers to live in moist clay or mud. They abound in the rice-fields, being thrown out on the land at certain seasons, when the ditches are cleaned. Formerly they were killed by the slaves, or mangled as being poisonous, and left to be devoured by birds and beasts of prey. Sometimes they leave the soft mud in which they burrow, and take to the water, in which they swim with great swiftness, and at others they go on dry land, but whether in search of food, or to rid themselves of parasitic insects, cannot be determined. Their range is from 45° N.L. to East Florida. They were first observed in South Carolina, and Dr. Garden noticed to Linnæus that they lived in dams and ponds.

FAMILY PROTEIDÆ.

The Eel-shaped *Proteus* is the type, and is found in Carniola and Dalmatia, living in the great underground wet caves and subterranean lakes and streams of those remarkable districts. It looks, when swimming, something like a Lizard, with small and very distinct hind and fore limbs, but there is a tuft of branchiæ on either side of the neck. The creature is more than a foot in length, and of the thickness of a finger, and the tail is compressed vertically. The fore limbs have three short digits, whilst the hind ones have two. Only two gill-clefts exist on either side, and there are rudimentary lungs besides the branchiæ. They are flesh-coloured creatures, and the gills are coral red, and the eyes are hidden in the skin, and are small, but useful. The blood corpuscles are immense, and about fifteen times the size of those of man.† A rather long but truncated snout is seen, and the palatine teeth are in two long rows.

A third family was formerly established to receive the remarkable North American genus *Menobranthus*, but it is by no means certain that these creatures are not the larvæ or the immature condition of an Amblystome called *Batrachocephalus*. The *Menobranthus lateralis* is from the Mississippi, and the Spotted *Menobranthus*‡ comes from Lake Champlain and elsewhere in the lake district of North America. The first has a long body, a flat and broad head, a large compressed tail, curved above. The eyes are small, the nostrils are in front, and the beautiful crimson-coloured branchiæ are three in number on each side, and there are two clefts on either side of the neck. The tongue is broad, entire, and free at the fore part, and there is a long, arched series of concentric teeth on the palate, on the front of the vomerine bones. The lower jaw has a pointed set of teeth, and the lips are fleshy. The extremities are four-cleft, and they are without claws. It is of a dusky ash-grey, with dark spots, and there is a streak from the snout over the eyes. They were first caught in baiting for Cat-fish, and were, of course, reputed poisonous, and much was made about them, although they do not often measure a foot in length. They crawl on the floor of the water, or swim with a serpentine movement, and feed on insects, worms, and shell-fish.

The second group of the Ichthyoidea, the *DEROTREMATA*, is remarkable for not having branchiæ

* *Siren lacertina*.

† *Proteus anguineus*.

‡ *Menobranthus punctatus*.



MENOBANCHIUS LATERALIS.

in adult age, and for having a gill-cleft on each side, and there are two families of them. The first, the Amphiumidæ, is represented by the long eel-like *Amphiuma*, of which there are two species, one with two and the other with three rudimentary digits. The first, *Amphiuma means*, lives in muddy waters, or in mud. Harlan says they have been found at Pensacola, three feet or more deep in mud of the consistence of mortar, in which they burrowed like earthworms. They inhabit the ditches of rice-fields, and feed on fish and the fresh-water *Unio*, on beetles, and other insects. Sometimes they are found on dry land. North and South Carolina, Florida, Alabama, and Mississippi are their commonest localities. The whole surface of the body is deep blue-black, tinged with violet, and the lips and throat are light, and the belly is dark-coloured. The single branchial cleft on each side is partly covered with a thin fold of skin. The body is eel-shaped, and the fore-limbs, close to the gill-clefts, have two small fingers, and the hind ones have the same number of toes. The tail is very long and compressed near the tip. The negroes call it the Congo Snake.

The other species, *Amphiuma tridactyla*, is so called from the number of its digits, but it appears, from the researches of Mr. Ryder, that the number of digits may vary in the same individual *Amphiuma*; there may be two or three. It is said that those with three digits invariably present are restricted to the Southern United States, while the two-toed form is more widely distributed, extending farther north, and also embracing the distribution of the former. Probably the distinction attempted to be made between *Amphiuma* with two and three toes is of no great importance.

Another family, the Menopomidæ, is represented by the Hellbender.* This ill-named Amphibian has a large, flat, broad head, and the snout is full and rounded, and the body is short, thick, and the tail is large, much compressed, and has a fin above. It is of a pale slate colour, mottled with dusky tints. It is carnivorous and very voracious, feeding on fish, worms, and shell-fish. It is found in the Alleghany river and its tributaries, and doubtless inhabits many of the branches of the Ohio and Mississippi. The mouth is large and covered with fleshy lips. The tongue is thin, broad, and flat, and is attached behind and below, and is free in front and at the sides. The superior maxillary teeth are arranged in two concentric series. The nostrils are in front, and are small, and the eyes are minute and black. The neck has a single gill-cleft at each side. The fore

* *Menopoma Alleghaniensis*.

limbs are short, thick, and fringed, and there are four fingers and five webbed toes. The total length is eighteen inches to two feet.

There is usually a specimen of a great, flat, almost triangular-headed Amphibian, which belongs to this family, with glistening white tips to its toes, in a glass case filled with water in the Zoological Gardens of London. It never seems to move, and a number of fish, supposed to be for its food, swim about it with perfect unconcern. It is a large, flat, Lizard-like thing, with a great tail, flat from side to side, and is nearly a yard in length. The eyes can scarcely be seen, and the dirty brown-coloured skin is warty and leathery-looking. No branchial clefts can be seen, and there are four toes in front and five behind. There is a kind of lobe behind the feet, and others on the sides of the toes, and a curious leathery skin fold is on the flanks of the body. The tongue is not distinct, and there are numerous palatine teeth.

It is a native of Japan, and is called after the naturalist Siebold * *Sieboldia* (or *Cryptobranchus*) *Japonica*, or is included in a genus *Cryptobranchus*.

ORDER APODA.

The last Amphibians to be noticed belong to this order, and have a serpentiform body, no limbs, and there are little scale-like bodies covering them, which are embedded in the soft, true skin, forming transverse rings. They have the shape and method of life of the Blind-worms, and of some of the small Snakes which lead a subterranean life, burrowing in the ground and eating worms and insects. But their internal anatomy distinguishes them readily. They have the eyes covered with skin; but all the anatomical parts of the eye are present, and vision takes place. Their mouth is.



SIPHONOPS ANNULATA.

small, and situated on the lower surface of the head, and there are two rows of teeth on the mandible. The two nostrils are well in front on the muzzle. One of them is found in the warmer parts of North America, growing to the length of twenty-three inches,* and having the thickness of a good-sized worm. It is agile under ground, moving in its own or other burrows; but little is known about its habits. It has some short conical teeth in the jaws and palatine bones, and has a little pit on the head on either side beneath the nostril, which is rather projecting. Certainly, during adult age, there are lungs, one, the right, being larger than the other, and there are no gill-clefts. But J. Müller states that when young there are internal branchiæ opening outwards through a cleft, in one kind, whilst it is certain that in other kinds the young are born breathing through lungs. But Gervais and Peters state that large vesicles, branchial in character, are found on the neck of the recently hatched individuals. The vertebræ are numerous and the centra are amphicoelous, and they have minute ribs. As in the other Amphibians, there are two occipital condyles to the skull and the hyoid bone, and the persistence of its arches would indicate that there is much to be learned regarding the early condition of these animals.

Mexico and the Brazils have another genus with a short muzzle and a broad and annulated body, and the pit is situated between the eye and the nostrils.† In Ceylon there is a flat-headed species with a pit in front of each eye,‡ and in Cayenne one exists without this little place at all.§

There are some peculiarities in the skulls of these burrowing worm-like Amphibia which Huxley has pointed out were foreshadowed in the great extinct Labyrinthodontia of the early age of Reptiles. The skull has a complete bony roof, and there is a quadrato-jugal bone besides the membrane bone, or temporo-mastoid. There is also a bone which seems to be the side nose-cartilage ossified, and another encircles the orbit, having no resemblance to any bone in the other living Amphibia. Moreover, the palate bones surround the back and outer edges of the inner nostrils.

CLASSIFICATION OF THE FAMILIES OF THE CLASS AMPHIBIA.

ORDER ANOURA (BATRACHIA PROPER).

SUB-ORDER AGLOSSA	{ Family Pipidæ.
	{ „ Dactylethridæ.
	{ „ Myobatrachidæ.
SUB-ORDER PHANEROGLOSSA.	{ Family Ranidæ.
	{ „ Pelobatidæ.
	{ „ Bufonidæ.
GROUP OXYDACTYLA	{ „ Rhinophrynidæ.
	{ „ Rhinodermatidæ.
	{ „ Engystomatidæ.
	{ Family Hylidæ.
GROUP DISCODACTYLA	{ „ Phyllomedusidæ.
	{ „ Dendrobatidæ.

ORDER URODELA.

SUB-ORDER SALAMANDRINA	{ Family Molgidæ.
	{ „ Salamandridæ.
	{ „ Plethodontidæ.
	{ „ Amblystomidæ.
SUB-ORDER ICHTHYOIDEA.	{ Family Sirenidæ.
GROUP PERENNIBRANCHIATA	{ „ Proteidæ.
	{ „ Menobrachidæ.
	{ Family Amphiumidæ.
SUR-GROUP DEROTREMATA	{ „ Menopomidæ.
	{ Family Cæcilidæ.

ORDER APODA

ORDER STEGOCEPHALA	{ GROUP GANOCEPHALA.
	{ „ LABYRINTHODONTIA.
	{ „ BRANCHIOSAURIA.
	{ „ MICROSAURIA.

THE EXTINCT AMPHIBIA

The most ancient Amphibia appear to have first lived during the Carboniferous age, and all were tailed, had pleurodont teeth, simple in their construction, and apparently there were no bony branchial arches present. The vertebral centra were ossified. Some were Lizard-like and others were more Serpentine, and one genus probably had no limbs. They are the Microsauria

* *Cecilia lumbricoides*.

† *Epicrion hypocyanea*.

‡ *Siphonops annulata*.

§ *Rhinatrema bivittata*.

(Dawson), and the genera *Hylerpeton* (Owen), *Hylonomus* (Dawson), *Brachydices* (Cope), and *Ophiderpeton* (Huxley), are typical. Associated with these, in the same formation, were the *Ganocephala* of Owen. These were like Salamanders in shape, and they had branchial arches, and the genera *Archegosaurus* and *Dendropteron* are typical genera. Numerous branchiated flat-headed *Branchiosaurs* (Fritsch) lived in the Carbo-Permian age, and they had simple teeth and the usual accessory bones of the skull, relating to the respiratory apparatus.

The Labyrinthodonts, with some alliances to the Apoda, had a very Crocodile-looking skull, but covered over by ornamented plates. It was broad behind—in one instance two feet broad and three feet long—had well-marked orbits, nostrils far in front, and long plates over the whole, very beautifully ornamented with ridges and grooves. The gape was wide, and the upper and lower jaws and palate bones were provided with conical teeth, some much longer than others. The cement of the tooth, instead of being folded around the tooth, is inflected or turned in, and not in a simple straight direction, so as to present in a cross section the appearance of straight spokes to a wheel, but in a curved and bent or serpentine direction. Moreover, the pulp cavity is subdivided into many radiating and branching segments, so that the combination of the outer and inner markings produces a most beautiful labyrinthic pattern. This condition was foreshadowed in some of the most ancient armour-plated fish, and is slightly noticed externally in some of the fossil marine Reptilia. The limbs were feeble in relation to the body. The markings in the clay and sandstone of Storton Hill, near Liverpool, as at Hessburg in Saxony, resemble “hands,” and they are the solid casts or impressions in relief of the five digits and claws of Labyrinthodonts. The possessor was called “Hand beast,” or *Chirotherium*. The limbs were Frog-like to a certain extent, and the chest and belly were protected with bony plates. The Labyrinthodonts were probably air-breathers in adult age only. Very Batrachian in their affinities, they were tailed, and there were two occipital condyles, and ossified vertebrae. They lived in the Carboniferous, Permian, and Triassic ages.

The ornamentation of the bones of the face, jaws, and skull, was remarkable in some instances, as was that of the bony skin plates; and the shape of the skull, elongate and Crocodilian in some, was like that of a broad-headed Frog in others. *Mastodonsaurus*, *Anthracosaurus*, *Pholidogaster*, *Baphetes*, *Trematosaurus*, *Labyrinthodon*, *Brachyops*, *Bothriceps*, and *Odontosaurus* are well-known genera. The *Microsauria*, *Ganocephala*, *Branchiosaurs*, and *Labyrinthodontia*, may be united in the order *Stegocephala* (Cope).

The Tailed Amphibia have been found fossil in Tertiary strata, and one in particular, at Eningen, a great depository of fossils. It was so large and peculiarly formed that it was at first considered to be a human skeleton, and its discoverer named it *Homo diluvii testis*. Cuvier, however, showed that it had belonged to an Amphibian of a Salamander type. It is since called after the discoverer *Andrias Scheuchzeri*. It is a *Sieboldia* or *Cryptobranchus*.

Tritons and small Salamanders have also been found fossil in Tertiary strata.

The genera *Rana* and *Bombinator* have been found represented by fossil species in early Tertiary deposits, and the extinct genera *Palæobatrachus*, *Palæophrynos*, and *Latonia*, are of the same and subsequent age.

P. MARTIN DUNCAN.

